DRAFT

ENVIRONMENTAL IMPACT STATEMENT FOR THE INTERAGENCY BISON MANAGEMENT PLAN FOR THE STATE OF MONTANA AND YELLOWSTONE NATIONAL PARK

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FOR THE
INTERAGENCY BISON MANAGEMENT PLAN
FOR STATE OF MONTANA AND YELLOWSTONE NATIONAL PARK

Bison are an essential component of Yellowstone National Park because they contribute to the biological, ecological, cultural, and aesthetic purposes of the park. However, Yellowstone National Park is not a self-contained ecosystem for bison, and periodic migrations into Montana are natural events. Some bison have brucellosis and may transmit it to cattle outside the park boundaries in Montana. Left unchecked, the migration of brucellosis-infected bison from Yellowstone National Park into Montana could have not only direct effects on local livestock operators, but also on the cattle industry statewide. The cooperation of several agencies is required to fully manage the herd and the risk of transmission of brucellosis from bison to Montana domestic cattle.

The purpose of the proposed interagency action is to maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana.

The U.S. Department of the Interior, National Park Service, and the U.S. Department of Agriculture, Forest Service, are the federal lead agencies. The state of Montana is the state lead. The U.S. Department of Agriculture, Animal and Plant Health Inspection Service, is a cooperating agency.

This environmental impact statement examines seven alternative means of minimizing the risk of transmitting the disease brucellosis from bison to domestic cattle on public and private lands adjacent to Yellowstone National Park. These alternatives each include a full range of management techniques, although they focus on one or two in particular. For instance, alternative 3 manages the bison herd primarily through hunting but includes provisions for quarantine. Alternative 5 proposes an extensive capture, test, and slaughter of bison that test positive for brucellosis. Alternative 6 is similar to alternative 5 but requires 10 years of vaccination before the test and slaughter phase begins. Alternative 1 is the no-action alternative. It continues the present plan of capture and slaughter of all bison crossing the north end and most bison crossing the west boundary of the park. Alternative 4 is similar to alternative 1, but would add quarantine, so that bison testing negative for brucellosis would not be slaughtered. Alternative 2 centers on changes in cattle operations and allows bison to range over the largest portion of their historic range. Alternative 7, the agencies' preferred alternative, focuses on maintaining the bison population below about 2,500 animals to minimize migration into Montana. Alternatives 2, 3, and 7 also include a framework for considering the acquisition of lands from willing sellers for use as winter range and for other bison management activities. Decisions to implement management actions on acquired lands will be supported with additional National Environmental Policy Act and/or Montana Environmental Policy Act analyses.

Implementation of the preferred alternative would result in adverse impacts on the bison population size, wildlife viewing opportunities, social values of some people, groups, or tribes, a few ranchers using public allotments on the Gallatin National Forest should those allotments be closed, wildlife species (particularly the pronghorn antelope, grizzly bear, and gray wolf), and visual resources of the area. Other alternatives might have these same impacts but could also affect winter recreation (particularly snowmobiling), nonmarket values, livestock operations, public funds (to acquire winter range), the trumpeter swan, bald eagle, lynx, and wolverine, and the historic landscape of the area. Alternative 2 would have significant beneficial impacts associated with the nonmarket values attributed to the well-being of bison, while this alternative would also present the greatest potential for the transmission of brucellosis from bison to cattle. Were that to occur, there would be major negative economic effects on Montana's livestock industry. Alternatives 2, 3, and 7 would have significant benefits for ungulates (elk, deer, pronghorn, and bison) if additional winter range could be acquired. Mitigating measures and some monitoring would be needed to avoid impacts on threatened or endangered species in alternatives 5 and 6.

Written comments on this draft environmental impact statement will be taken for a period of 120 days. The review period for this document ends October 1, 1998. Comments should be sent to Sarah Bransom, Interagency Bison Management Plan, DSC-RP, P.O. Box 25287, Denver, CO 80225-0287

SUMMARY

PROPOSED ACTION

This environmental impact statement analyzes impacts of several different means (alternatives) for the interagency, long-term management (assumed for purposes of analysis to be 15 years) of Yellowstone area bison to ensure domestic cattle in portions of Montana adjacent to Yellowstone National Park are protected from brucellosis, a disease some of these bison carry, and to ensure the viability of the bison herd. Each alternative requires the cooperation of the U.S. Department of the Interior's National Park Service (NPS), the state of Montana, and the U.S. Department of Agriculture's Forest Service (USFS) and Animal and Plant Health Inspection Service (APHIS), as all have jurisdiction over a portion of the management effort, either directly or indirectly. At this time alternative 7, maintaining a specific bison population range, is the agencies' preferred means of management.

PROJECT LOCATION

The analysis area is a part of what is often described as the Greater Yellowstone Area, the largest and most nearly intact ecosystem in the contiguous United States (Greater Yellowstone Coordinating Committee 1991). The portion specifically subject to analysis includes those areas in Yellowstone National Park habitually occupied by bison (approximately 1.75 million acres) and adjacent federal, state, and private lands outside the park in southwestern Montana (parts of Park and Gallatin Counties) that have been periodically occupied by Yellowstone bison over the past 12 years.

The area outside the park includes approximately 568,994 acres, of which about 97% is managed by Gallatin National Forest, 1% by state or local government, and 2% by private owners.

NEED FOR ACTION

Bison are an essential component of Yellowstone National Park because they contribute to the biological, ecological, cultural, and aesthetic purposes of the park. However, Yellowstone National Park is not a self-contained ecosystem for bison, and periodic migrations into Montana are natural events. Some bison have brucellosis and may transmit it to cattle outside the park boundaries in Montana. As bison migrate out of the park and into Montana, they move from one jurisdiction with management objectives to a different jurisdiction with different management objectives. Therefore, the cooperation of several agencies is required to fully manage the herd and the risk of transmission of brucellosis from bison to Montana domestic cattle.

Bison exiting Yellowstone National Park through north entrance near Gardiner, Montana.

PURPOSE OF ACTION

The purpose of the proposed interagency action is to maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana.

BACKGROUND

The Yellowstone Area Bison Herd

Bison are native to the Greater Yellowstone Area and were observed there by early travelers both before and after the creation of Yellowstone National Park in 1872 and the Yellowstone Timber Land Reserve in 1891.

Hunting and poaching of bison in the late 1800s substantially reduced the number of bison in the Yellowstone herd, and by 1902, only 23 were counted. Fearful the small wild herd might vanish, park managers imported 21 bison from captive herds into the park. These bison were raised using livestock techniques on the "Buffalo Ranch" in Lamar Valley until the 1930s, when the National Park Service gradually began efforts to restore the bison to a more natural distribution (NPS, USDI, Meagher 1973). However, artificial feeding of the Lamar Valley herd, herd reductions to achieve range management goals, and other manipulation of the population continued from the 1920s until the late 1960s, and were often quite intensive. The highest reported bison count during this period was 1,477 in 1954.

In 1967, when herd reductions in the park ceased as part of a larger redirection of park policies, 397 bison were counted. Since that time bison, elk, and other animals have been allowed to reach population levels dictated by environmental conditions.

In 1968, in response to livestock industry concerns over brucellosis, the National Park Service proposed a program to control bison at the boundary of the park. More recently, a series of four interim bison management plans (the latest in 1996) put specific boundaries and lethal control measures in place. In 1996–97, a particularly harsh winter with deep snow and ice conditions sent hundreds of bison toward park boundaries, seeking accessible forage at lower elevations. Implementation of the interim plan, combined with the severe winter conditions, resulted in the slaughter or shooting of 1,084 bison in the five months between November 14, 1996, and April 15, 1997. Others died of starvation or other natural causes inside the park, bringing the total population down from an estimated 3,500 in fall 1996 to an estimated 2,000 animals by early spring 1997.

Brucellosis in Cattle and Bison

Brucellosis is a contagious bacterial disease, caused by various species of the genus, *Brucella*, that infects domestic animals, wildlife, and humans worldwide. *Brucella abortus* is the species that infects both cattle and bison. There is no cure for brucellosis. Vaccines developed so far are not 100% effective, and are to date less effective with bison than with cattle. The first known case of brucellosis in the bison herd was reported in 1917. It is generally agreed that the transmission of brucellosis to the Yellowstone bison herd was from cattle, and occurred either through contact with infected cattle or from infected cows' milk fed to captive bison calves.

In cattle, the organism is shed primarily in aborted tissues, reproductive tissues, and discharges, especially just before, during, or soon after abortion or live birth. Ingestion by other cattle of contaminated material is the primary route of infection. Cows infected with brucellosis characteristically abort their first calf after the fifth month of gestation.

Less is known about the disease in bison, particularly free-ranging bison. Transmission from bison to cattle has occurred under experimental conditions in confined spaces, but has not been documented under free-ranging conditions.

Diagnosis. In cattle, diagnosis is based on the results of blood tests, herd history, clinical signs, and other information. The only sure way to know if an animal has the disease is to slaughter it and culture tissues from several locations for bacteria. In Yellowstone bison, agencies have used a blood test for the presence of *Brucella* antibodies. For a number of reasons, these blood tests tend to overestimate the number of bison actually harboring the bacteria. Difficulties in

isolating the bacteria from tissues and other factors have also meant fewer positive culture tests than the number of infected bison.

Risk of Transmission. Scientists and researchers disagree on even some of the most basic factors influencing the risk of transmission. These include whether studies on cattle are applicable to bison, whether controlled studies are applicable in the field, and the best ways to conduct additional research to determine the risk of transmission.

These disagreements and a paucity of information on brucellosis in bison make it impossible to quantify the risk of *B. abortus* transmission from bison (and elk, although this environmental impact statement does not analyze brucellosis in elk) in the Yellowstone area to domestic livestock. Instead, the agencies have identified factors that affect risk. They include the following:

1. The degree of association between potentially infectious and susceptible animals. Management actions emphasize separation to minimize risk.
2. The number and density of infectious animals in the host population.
3. The number of susceptible animals that may associate with infectious animals.
4. Environmental factors such as weather, sunlight, and other factors that determine the viability of the organism outside its host.
5. The class of the infectious animals. Because the disease is transmitted in cattle through ingestion of contaminated birth materials, pregnant bison are considered higher risk than other classes.
6. Vaccination and neutering reduce the transmission of the disease.
7. Some animals are naturally resistant to infection.

Alternative Interpretation of Risk. The above information represents areas where scientists generally agree on the interpretation of available data. However, considerable debate and need for additional research remain. The bulk of brucellosis research and disease management has focused on domestic livestock, yet limited published information suggests the disease may be transmitted differently and have different clinical, pathological, and population effects in bison (Williams, Cain, and Davis 1994; Meyer and Meagher 1995a).

Those who suggest the risk is negligible point out that there have been no documented cases of brucellosis transmission from wild, free-ranging bison to cattle.

It is possible that, although brucellosis may be endemic in the Yellowstone area bison herd, few of the animals are capable of transmitting the disease. This suggestion is supported by noting the discrepancy between the number of bison that test seropositive for brucellosis but culture tissue negative (Rhyan et al. 1997). This discrepancy and the infrequency of observed abortions in the Yellowstone bison herd (usually required for transmission of the disease between cattle) has led to the theory that the primary route of transmission among cattle (abortions and birthing events) may be different from that among bison. In bison, the bacteria may be transmitted through milk (Meyer and Meagher 1995a).

Bison Distribution

The Yellowstone bison population uses three different wintering areas in the park: Pelican Valley (the smallest), Mary Mountain (the largest, in the Hayden Valley-Firehole River area), and the northern range. Yellowstone National Park grooms roads in the winter for snowmobile use, which allows bison to easily traverse the park. Bison seem to use the roads to exit in severe winters, such as the 1975–76 and 1996–97 winters, and retain the memory of the access routes (Meagher 1989a). While experts agree that bison traveling on groomed routes are

traveling in a more energy-efficient manner than bison traveling through deep snow, there is disagreement about what bison would do if grooming ceased. What result this would have on bison numbers and distribution is not known. Bison migrate across the north and west ends of the park during the winter into Montana. In the north they exit primarily across the Reese Creek boundary of Yellowstone National Park, and move immediately onto adjacent private land where several hundred cattle are present year-round.

Bison may also enter national forest land in the Eagle Creek/Bear Creek area east of Reese Creek, where they occasionally enter private lands in the Gardiner area by traveling along the Maiden Basin hydrographic divide and Little Trail Creek drainage. These lands are collectively referred to as the Eagle Creek/Bear Creek "special management area" (areas outside the park where bison are allowed) in this document. To the east of these lands (and north of the park) lie Hellroaring and Slough Creek drainages and the Absaroka-Beartooth Wilderness, part of the national forest where cattle are not present. A few bison use these higher elevation, more rugged lands in winter and summer.

From the west side of the park, bison move along the Madison River, Duck Creek, and Cougar Creek in the vicinity of West Yellowstone. From here, bison infrequently move north (usually along Highway 191) onto public lands administered by the U.S. Forest Service in the Cabin Creek Recreation and Wildlife Management Area and the Monument Mountain Unit of the Lee Metcalf Wilderness. The western special management area (SMA) in this document includes these lands south to the West Yellowstone area. Up to a few hundred cattle may occupy select public and private lands in the West Yellowstone area in the summer months. No cattle are present in the winter.

Economic Impacts of Brucellosis in Cattle

Brucellosis (*B. abortus*) has the following direct impacts on the livestock industry:

- Abortion of calves
- Decreased weight gain by calves
- Delays in calf production
- Increased rates of culling and replacement
- Increased testing and vaccinating costs

The presence of livestock disease may also affect each state's classification by the Animal and Plant Health Inspection Service. Montana is currently "class-free" and can transport its cattle across state lines without testing for brucellosis. Downgrading would have extensive economic ramifications throughout the livestock industry in Montana by restricting ranchers' access to interstate and international livestock markets. Interstate limits on Montana producers' ability to market livestock may also come about from actions of state veterinarians whose states import Montana cattle and who see Yellowstone cattle as a potential disease threat. The potential for such widespread economic consequences is a primary motivating factor in taking management actions described in the alternatives in this environmental impact statement.

OBJECTIVES AND CONSTRAINTS IN TAKING ACTION

In addition to the above-stated purpose, the agencies have agreed that nine objectives would guide them in determining whether an alternative is reasonable, and in selecting the preferred alternative. Each alternative must meet the following objectives:

1. Address bison population size and distribution; have specific commitments relating to size of bison herd.

2. Clearly define a boundary line beyond which bison will not be tolerated.

3. Address the risk to public safety and private property damage by bison.

4. Commit to the eventual elimination of brucellosis in bison and other wildlife.

5. Protect livestock from the risk of brucellosis.

6. Protect the state of Montana from risk of reduction in its brucellosis status.

7. At a minimum, maintain a viable population of wild bison in Yellowstone National Park, as defined in biological, genetic, and ecological terms.

8. Be based on factual information, with the recognition that the scientific database is changing.

9. Recognize the need for coordination in the management of natural and cultural resource values that are the responsibility of the signatory agencies.

Another important factor in deciding the reasonableness of alternatives are agency constraints imposed by laws, regulations, or other requirements. All alternatives must be within these constraints to be a viable choice. A summary of legislative and regulatory requirements of each of the four agencies involved in bison management is provided in part 1, "Purpose of and Need for Action."

ISSUES

Public scoping identified several environmental problems (issues) that should be addressed in a cooperative bison management plan. Scoping also identified other objectives and alternatives the public wished agencies to consider in their planning. The resources that agencies believed would experience more than negligible impacts are listed below, and each is analyzed in the environmental impact statement:

- the Yellowstone area bison population size, distribution, and seroprevalence
- recreation
- socioeconomics, including the regional economy, minority and low-income populations, social values, and nonmarket values
- livestock operations in the region
- threatened and endangered species, such as the grizzly bear, and sensitive species or species of special concern
- other wildlife
- human safety
- cultural resources
- visual resources

Bison calf.

ALTERNATIVES

This environmental impact statement evaluates seven alternatives for the long-term management of bison. Alternative 1 is the no-action alternative (continue with existing interim plan), and alternative 7 (manage for specific bison population range) is the agencies' preferred alternative at this time. Each of the seven alternatives has several features in common, including the following:

- All alternatives require the cooperation of the state of Montana, the U.S. Forest Service, the National Park Service, and the Animal and Plant Health Inspection Service.

- Every alternative envisions the bison population would be managed primarily through natural processes inside Yellowstone National Park.

- In all alternatives (except alternative 5 in the short term), the use of lethal controls to manage bison is minimized as the population size approaches 1,700 animals.

- All alternatives include large geographic areas where bison are able to range with little human intervention. In alternative 5, this area is limited to Yellowstone National Park.

- Monitoring is an integral part of every alternative, especially as bison approach designated border areas in Montana.

- All alternatives define a management boundary beyond which agencies would take action to ensure bison do not remain.

- If a capture facility is sited as part of an alternative, it would meet certain environmental criteria and comply with requirements of the Endangered Species Act and the National Historic Preservation Act before construction began.

- All alternatives include humane treatment of bison held in capture or quarantine facilities.

- All alternatives except alternative 5 allow bison outside the park. To do so and not affect Montana's class-free status, special management areas (SMAs) would be created. The creation of these SMAs would not require changes to current APHIS regulations, but would require the approval of the state of Montana as specified by Montana law.

- Slaughtered bison could be auctioned or distributed to social service organizations. Bison shot in the field may be released to tribes. Live bison would be available if they had completed the approved quarantine protocol.

- In Montana, private landowners may shoot bison on their land with permission from the Department of Livestock, or they may ask the department to remove bison.

- All alternatives include the suggested vaccination of female cattle calves in areas adjacent to the park or in SMAs, as well as surveillance testing of these herds should contact with bison be suspected or occur. All alternatives also assume vaccination of bison calves and captured adult bison when a safe and effective vaccine is available.

- All alternatives include future research efforts.

Alternative 1: No Action – Continuation of the Current Interim Bison Management Plan

Adopting this alternative would continue current bison management as set forth in the 1996 *Interim Bison Management Plan* as defined by National Environmental Policy Act (NEPA) guiding regulations (40 CFR 1502.14). The interim plan relies on strict border enforcement to keep bison and cattle separate, and has no provision for the quarantine of bison. Bison are prevented from crossing the northern park boundary at Reese Creek because the adjacent land is private and occupied by cattle throughout

the year. All bison captured at the Stephens Creek facility are shipped to slaughter.

Bison are allowed in the Eagle Creek/Bear Creek area, a large tract of public (U.S. Forest Service) land north and east of Reese Creek. The Department of Livestock, with help from the agencies, maintains a boundary at Little Trail Creek/Maiden Basin hydrographic divide in the Eagle Creek/Bear Creek area. Bison moving north of this boundary and approaching private land in the Gardiner area are removed by agency personnel with the permission of the landowner.

In the West Yellowstone area, public lands administered by the U.S. Forest Service are adjacent to the park. Cattle are more dispersed than at Reese Creek and are not grazed during the winter months. Up to 50–100 seronegative nonpregnant bison in the West Yellowstone area are able to overwinter successfully outside the park without coming in contact with cattle. Seropositive, untested, or any pregnant bison are removed. Bison are excluded from the West Yellowstone area from May through October to prevent contact while cattle occupy the region. Bison located outside the park in the west boundary area would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. In addition, a handful of bison (usually single bulls) use the Cabin Creek/Lee Metcalf area on the west, or Hellroaring and Slough drainages to the north and east of Eagle Creek/Bear Creek. Those few that do move beyond the borders of either of these large tracts of public land would be hazed or shot.

Although agencies have made subsequent changes to the interim plan, these are not reflected in the description or analysis of the no-action alternative. In other words, existing conditions were assumed to begin when the analysis in this environmental impact statement began in spring 1997. Changes in the interim plan made since this time are included in appendix A for the reader's information.

Alternative 2: Minimal Management

The purpose of this alternative is to restore as near-natural conditions as possible for bison, including a small portion of their historic nomadic migration patterns. The area outside Yellowstone National Park over which bison would be able to range (e.g., the SMAs) without interference from agencies is the largest of all alternatives.

In each alternative, including alternative 2, many changes, such as land acquisition, changes in cattle operations, and a safe and effective bison vaccine, are described. Each of these involves some unknowns, as well as time to implement. Therefore, until these changes were in place, relevant management tools in the interim plan would remain in effect. The description below assumes these changes have been made.

The primary means to minimize the risk of disease transmission would be changes in cattle operations in the SMAs. This alternative would provide for lethal control of bison only in cases where human safety was in immediate danger, on private property at the request of the landowner, or outside the SMA border. Bison would not be captured or slaughtered by agencies. A key tool available to restore natural conditions and help control bison distribution would be the closure (e.g., discontinuing grooming) of winter groomed roads in Yellowstone National Park that the animals now use to traverse the park. Bison have "discovered" these pathways from the interior to both the northern and western boundaries of the park, and can use them routinely during the winter to access areas they would otherwise have more difficulty reaching. It is hypothesized that the energetic cost of traveling long distances on groomed roads would be low, and they in effect could be allowing bison to access other foraging areas, leave the interior, and move to boundary areas. Alternative 2 would be the only alternative to propose changes in winter operations in some segments of park roads to control bison distribution, although other alternatives include research on the use of roads and potential barriers to bison travel (alternative 3), and

plowing to access capture facilities (alternatives 5 and 6).

In addition to leaving road segments ungroomed, the agencies would maintain boundary lines through hazing and shooting. Landowners could request bison on their property be removed, or could shoot them with permission of the Montana Department of Livestock. Cattle operators on private lands inside designated SMAs might be offered incentives to remove susceptible (breeding) cattle, or grazing rights, easements, or property in bison winter range might be purchased from willing sellers to remove cattle altogether. In addition, public grazing allotments might be modified to accommodate bison.

Alternative 3: Management with Emphasis on Public Hunting

Alternative 3 would rely on hunting of bison to regulate population numbers and distribution of bison outside the park, and on separation of bison in time and space to preclude contact of bison with cattle. Where hunting was infeasible or inappropriate, capture and shipment of sero-positive bison to slaughter and seronegative bison to quarantine would be used to maintain separation and manage the risk of disease transmission. As in other alternatives, bison would be vaccinated when a safe and effective vaccine was developed to further reduce this risk. This alternative would have both a distinct short-term (phase 1) and a long-term (phase 2) management strategy.

In the short term, the separation of cattle and bison on the northern (Reese Creek) boundary would be maintained through capture at Stephens Creek and the shipment of sero-positives to slaughter and seronegatives to quarantine (or slaughter until the quarantine facility was built). Under the provisions of the interim management plan, the agencies now ship some of the bison captured at Stephens Creek to slaughter. A quarantine facility would give the agencies flexibility in the disposition of seronegative bison they do not now have.

Bison that completed the entire quarantine procedure would be shipped live to requesting tribes or organizations, or used to repopulate herds on public lands. The location, design, and operation of a quarantine facility has not been determined, and an appropriate range of alternatives with different features would be evaluated before one was built. Additional NEPA and other compliance would be required to build such a facility on federal land or use federal money. Until the time a quarantine facility was constructed (assumed for the purposes of analysis to begin in 1999), all seronegative bison captured at Stephens Creek would be sent to slaughter.

The Department of Livestock, with help from the agencies, would maintain a boundary at Little Trail Creek/Maiden Basin hydrographic divide similar to alternative 1. Bison moving north of this boundary would be removed by agency personnel with the permission of the landowner.

Bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. As in alternatives 1 and 4, agencies would also maintain a boundary at the north end of the Cabin Creek Recreation and Wildlife Management Area/Monument Mountain Unit of the Lee Metcalf Wilderness. Hunting would be used in both the Eagle Creek/Bear Creek and western SMAs to help control population numbers and distribution. Research on the degree to which the winter grooming of park roads contributed to migration out of the park would continue, and changes in road grooming practices would be made in the long term if research showed they were warranted. These changes would be implemented through amendments to the park's winter use plan and appropriate NEPA documentation.

In the long term, alternative 3 would call for acquisition of bison winter range through purchase of grazing rights, easements, or

property from willing sellers, alterations in cattle allotments, and/or changes in livestock operations to remove susceptible cattle. This newly acquired winter range would be designated as the Reese Creek SMA, and would include lands on the west side of the Yellowstone River between Reese Creek and Yankee Jim Canyon. If suitable land north of the park was acquired through purchase or easement, the Stephens Creek capture facility might be moved to a different location. The Department of Livestock, with help from the agencies, would maintain a boundary at Yankee Jim Canyon, and hunting in the Reese Creek SMA would be used to help control population size and distribution of the bison herd.

If this alternative was selected, the agencies would request the 1999 Montana Legislature to authorize a fair-chase hunt for bison. Public hunting would then become the primary tool for agencies to control population sizes in the new Reese Creek SMA, and would also be allowed in the Eagle Creek/Bear Creek area and western SMA.

Modifications in grazing allotments, acquisition or easement of private land, or conversion from cow-calf to steer or spayed heifer production are options in this alternative for the West Yellowstone area to further reduce the risk of bison commingling with susceptible cattle.

Alternative 4: Interim Plan with Limited Public Hunting and Quarantine

The interim plan (no action, or alternative 1 in this analysis) has served to ensure spatial separation of the bison herd from domestic cattle on the northern and western borders of Montana. However, it has given agencies few options when harsh winters force more than the average number of bison toward the boundaries of Yellowstone National Park. For this reason, alternative 4 includes a quarantine facility to preserve seronegative bison captured at Stephens Creek. Bison completing the quarantine protocol would be released to tribes, requesting organizations, or to repopulate herds on public lands. The location of the facility has not been determined, and locating it on federal land or using federal money would mean subsequent NEPA analysis, including public input, would be required.

Hunting, should it be approved by the Montana Legislature, would be another tool proposed to help agencies control population numbers and distribution. A limited hunt, primarily for recreation, would be allowed in the West Yellowstone and Eagle Creek/Bear Creek areas.

Except for these differences, alternative 4 would be identical to the interim management plan, alternative 1.

Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Removal

This alternative would implement an aggressive three-year capture and test program for all bison in the park, including those in its interior. Those testing negative would be released in the park, and seropositives would be shipped to slaughter. If a safe and effective vaccine was available, seronegative bison would also be vaccinated. Bison would not be allowed outside the park anywhere in Montana, and agencies would maintain northern and western boundaries. Bison at these boundaries would be hazed back into the park if possible, but shot if they were unresponsive to hazing. Capture facilities would be set up in nine areas. All untested bison would be shot in the latter stages of the capture, test, and slaughter program. When subsequent testing indicated brucellosis had been eradicated from the bison population, a new bison management plan would be prepared.

Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination

This alternative, like alternative 5, would pursue the aggressive reduction of brucellosis from the Yellowstone bison herd. However, the entire

bison herd would first be vaccinated (when a safe and effective vaccine was available), primarily through remote means, and tested as they attempted to exit at park boundary locations. When tests showed the incidence of exposure to *B. abortus* had stabilized as a result of vaccination, (estimated to occur in 10 years) the herdwide capture, test, and slaughter of seropositive bison outlined in alternative 5 would begin.

Unlike alternative 5, bison would be allowed in the Eagle Creek/Bear Creek and western SMAs, although the majority of bison in the western SMA would be tested and released sero-negatives. The National Park Service would construct and operate a capture facility at Seven-Mile Bridge inside the park on the west side. Nearly all bison migrating toward the West Yellowstone area cross through this narrow area. These facilities (at Duck Creek and the Madison River) would be dismantled, although a small, backup capture facility near Horse Butte, might be maintained.

Alternative 7: Preferred Alternative – Manage for Specific Bison Population Range

The preferred alternative departs from all other alternatives in that a range of bison population numbers would be the focus, and specific management scenarios would be put in place as the population approached either end of that range. This range would be from 1,700 to 2,500 bison. Agency controls would decrease as the bison population approached 1,700 and would cease at 1,700 bison in certain areas as described in management sections for each area. Additional measures to remove increasing numbers of bison would be implemented near the 2,500 mark if bison left the park or SMAs described in this alternative. Because bison removals occur at or outside the park boundary, the bison population could at times exceed 2,500 inside the park.

In the long term, the agencies might acquire access to additional winter range in the Gardiner Valley on the west side of the Yellowstone River through purchase of grazing rights, easements, or property from willing sellers. If acquired, this tract would be designated an SMA subject to the approval of the state of Montana as specified by Montana law. The capture facility now located at Stephens Creek could be dismantled and moved to an appropriate location in the SMA. No modifications in grazing allotments or acquisitions of property, easements, or grazing rights in the western SMA would be anticipated.

Although the preferred alternative (alternative 7) is distinct, it has elements similar to other alternatives. Capture and slaughter of seropositives would be the primary means of managing risk, as it is in alternatives 1, 4, and 5. Most seronegative bison would be shipped to quarantine, as described in alternative 4. Also like alternative 4, low levels of hunting would be allowed in one or more of the SMAs outside the park. As in alternative 3, the preferred alternative has a long-term phase that proposes the acquisition of winter range north of the park boundary. However, as described above, this alternative is much more specific in defining a population size and management tools to keep it at that size. It is also true that alternatives 1 through 6 are unique, as each emphasizes a particular strategy to manage bison or combination of strategies not analyzed in alternative 7.

Stephens Creek capture facility.

ENVIRONMENTAL CONSEQUENCES

The environmental impacts of each alternative were analyzed and compared to existing conditions. Below is a summary of those impacts.

Impacts on Bison Population

A simple model based on averages (deterministic) was used to predict changes in bison populations and/or seroprevalence rates should a given alternative be implemented. Because a single severe winter, such as the 1996–97 winter, could alter estimates of bison numbers significantly, the analysis also includes a section on the effects of small, average, and large-scale migrations out of the park in response to these "stochastic" events on the population size.

The deterministic model predicts the continued implementation of alternative 1 would result in a growing bison population. From 1997 to 2006, the bison population would increase at 4% per year to approximately 3,100. Management actions in this alternative would not measurably affect the age/sex distribution or reproductive rates of bison in this or any alternative except for alternative 5. Bison distribution outside the park is indicated in chart 1. In this, and all other alternatives except alternative 5, 100–200 bison would freely range on public lands in the Eagle Creek/Bear Creek area.

Alternative 2 would result in the largest and fastest growth of the bison population of all alternatives. From 1997 to 2006, the population is expected to increase to 3,500, moderately more bison (14%) than in alternative 1.

Alternative 3 would result in growth of the bison population, with numbers controlled primarily through hunting. From 1997 to 2006, the bison population would be expected to increase from about 2,200 to 3,500 (average increase 6%/year). Limited capture operations, agency shooting, hunting, and periodic severe environmental conditions would likely maintain the bison population near the upper management range of 1,700 to 3,500. It is estimated that alternative 3 would result in moderately more bison in the population (14% increase) compared to alternative 1.

In alternative 4, bison population numbers would be controlled through capture, shipment of seropositive bison to slaughter, and hunting. This alternative would result in a slowly increasing bison population with lower population numbers than alternatives 1, 2, 3, or 6. From 1997 to 2006, the bison population would be expected to increase from about 2,200 bison to 2,800 (average increase 3%/year). This would be a minor decrease (8% lower) in bison population size relative to alternative 1.

For alternative 5, the bison population would be expected to decline from 2,200 bison to approximately 1,250 bison by 1999. The bison population would be expected to number approximately 2,000 by 2006, and approximately 2,900 bison by 2011, 10 years after capture, test, and slaughter operations have ceased. No bison would be expected in Reese Creek, Eagle Creek/Bear Creek, or West Yellowstone in this alternative. The bison population would experience a major decrease in this alternative, representing a nearly 47% reduction, compared to alternative 1, over a period of only three years.

No bison would be allowed anywhere outside Yellowstone National Park boundaries under alternative 5. Management actions in alternative 5 could affect the age/sex distribution or reproductive rate of the bison population. Bison distribution within the park would likely be affected, and several areas would likely have few or no bison for as long as 10 years.

In alternative 6, all bison would be vaccinated for approximately 10 years (beginning in the year 2000) to reduce seroprevalence in the population. After whole herd vaccination, bison would be captured, tested, and seropositives slaughtered, similar to alternative 5. Two different estimates of population size were calculated based on the effectiveness of the vaccine. Assuming a 70% effectiveness, the

bison population would be expected to increase during the vaccination phase from 2,200 bison to approximately 3,500 bison in 2010, a negligible to minor increase compared to alternative 1. After 10 years of vaccination (2010), capture and slaughter would begin, and the population would drop from 3,500 to about 2,900 in a single year, a moderate (17%) decrease compared to alternative 1. If the vaccine was only 25% effective, the population would drop from 3,500 animals in 2010 to 2,500 the following year, when parkwide capture and slaughter began. This would represent a major short-term adverse impact (28% reduction) on the population. The herd would begin to increase following completion of the test and slaughter program; from 2,900 to 3,400 bison by 2014 (assuming 70% effectiveness), or from 2,500 to about 3,000 animals (assuming 25% effectiveness) by 2014.

Unlike other alternatives, in alternative 7 the agencies would attempt to manage the bison population within the more narrow range of 1,700 to 2,500 animals. Given the mix of management tools described above in "The Alternatives," the model predicts the bison population would be expected to increase from about 2,200 bison to 2,700 (average increase 2.6%/year) in 2004, and level off at or about 2,700 throughout the remainder of the 15-year plan. This alternative would result in a bison population 12% lower than alternative 1 in 2006 and 23% lower in 2011. However, because of limitations with the deterministic model, the differences between alternatives 1 and 7 might be less. Slaughter, quarantine, agency shooting, and hunting are predicted to remove an average of 132 to 137 bison per year. If bison exited the park in larger numbers during severe winters, more would be killed if the bison population was near or above 2,500 animals. During mild winters, fewer bison would exit the park and thus fewer bison would be killed.

Stochastic Influence on Bison Population. Chart 2 indicates how alternatives would vary in handling a large migration (975 bison) out of the park in response to a stochastic or periodic event, such as severe winter weather. Additional removals might include shipment of sero-negative bison to slaughter or quarantine, or additional agency shooting or increases in the number of hunting permits issued, and would depend on the bison management tools available in a given alternative. Each action assumes all elements of the alternative would be in place (e.g., phase 2 of the alternative).

Seroprevalence Rate. Modeling efforts for this environmental impact statement assumed 50% seroprevalence in the bison population. The model also assumed either a 70% rate of effectiveness of the bison vaccine (based on current success with cattle) or 25% rate of effectiveness (based on effectiveness in bison calves). Bison calves were assumed to be vaccinated with a safe and effective vaccine beginning in 2000.

Assuming a vaccine that was 70% effective and calfhood vaccinations began in 2000, the population seroprevalence rate under alternative 1 would be expected to decline from a starting point of 50% seropositive in 1997 to at least 33% seropositive in 2006 (see chart 3). If the vaccine was 25% effective, seroprevalence was predicted to drop from 50% to 40% by 2006. Continued management efforts and calfhood vaccination (assuming 70% efficacy) would reduce seroprevalence to 24% in 2011.

In alternative 2, the population seroprevalence rate would be expected to decline to at least 34% seropositive in 2006 (assuming 70% efficacy) or to 42% by 2006 (assuming 25% efficacy). Continued management efforts and calfhood vaccination (70% efficacy) would reduce seroprevalence to 26% in 2011. This would represent a minor adverse impact (3% to 8% less reduction) compared to alternative 1.

In alternative 3, the population seroprevalence rate would be expected to decline to at least 36% seropositive in 2006, assuming a 70% vaccine efficacy. With calfhood vaccination and a vaccine efficacy of 25%, seroprevalence was predicted to drop to 45% by 2006. Continued management efforts and calfhood vaccination

Chart 1: Population Changes Predicted to Occur Using Deterministic (Averaging) Model

Alternative	Population Size (1997)	Population Size (2006)	Population Size (2011)	Number of Bison in Western SMA	Number of Bison in Reese Creek SMA
1	2,200	3,100	3,500	18–52	0
2	2,200	3,500	3,500	20–60	0–120
3	2,200	3,500	3,500	16–120	60–80
4	2,200	2,800	3,200	1–52	0
5	2,200	2,000	2,900	0	0
6	2,200	3,100	2,900	22–60	0
7	2,200	2,700	2,700	13–51	0–100

Chart 2: Number of Bison Slaughtered, Hunted, Quarantined, and Ranging in Special Management Areas if 975 Bison Were to Leave the Park (Represents 90% of the Highest Number of Bison to Historically Leave the Park -1,084)

Alternative	Slaughtered	Hunted	Quarantined	Additional Removals[a]	Total Removed	Number Ranging in SMAs
1	829	0	0	0	829	146
2[b,c]	0	0	0	0	0	975
3[b]	0	60–70	0	705–715	765–785	200
4[b]	498–823	20	331–6	26	875	100
5	975	0	0	0	975	0
6	810	0	0	65	875	100
7[b]	166	20	23	566	775	200

a. According to the alternative, additional removals might include bison shipped to slaughter, quarantined, hunted, or shot by agency personnel.

b. Assumes all elements of the alternative were in place (phase 2).

c. If 975 bison were to exit the park, the possibility exists that some bison might move onto private land or attempt to move beyond SMA boundaries and be shot, if hazing were unsuccessful. Predicting the total number of bison that may move beyond the boundaries of the SMAs and be shot is not possible, but it might likely be greater than zero.

Chart 3: Predicted Seroprevalence Rates for Each Alternative Using Deterministic (Averaging) Model

Alternative	Seroprevalence 2006 (assuming 70% efficacy)	Seroprevalence 2006 (assuming 25% efficacy)	Seroprevalence 2011 (assuming 70% efficacy)
1	33	40	24
2	34	45	26
3	36	45	28
4	34	42	26
5	0	0	0
6*	32	40	0
7	32	40	23

* For both vaccine efficacies, seroprevalence would be 0% after completion of capture, test, and slaughter operations by 2013.

(70% efficacy) would reduce seroprevalence to 28% in 2011. This would be a minor to moderately higher seroprevalence (9%–17% higher) than that predicted for alternative 1.

In alternative 4, capture and removal of sero-positive bison, and calfhood vaccination (70% efficacy) was predicted to decrease sero-prevalence to at least 34% in 2006 and 26% in 2011. Assuming a 25% vaccine efficacy, sero-prevalence would drop to 42% by 2006. This would be a minor adverse impact (3%–5% higher seroprevalence) compared to alternative 1.

In alternative 5, the seroprevalence rate in bison would be expected to drop from 50% in 1997 to 0% in 2001, assuming 70% vaccine efficacy, capture, test, slaughter operations, and whole-herd vaccination. In the 25% vaccine efficacy model the seroprevalence rate dropped to 0% by 2001. This would be a significant decrease in the seroprevalence rate and a major beneficial impact compared to alternative 1.

In alternative 6, the seroprevalence rate would remain similar to alternative 1 during the vaccination phase (2000–2010), and then drop to 0% by 2013. This would be a major reduction in seroprevalence compared to alternative 1.

In alternative 7, the population seroprevalence rate would be expected to decline from a starting point of 50% seropositive in 1997 to at least 32% seropositive in 2006 due to removal of seropositive bison leaving Yellowstone National Park in the West Yellowstone and Reese Creek area, and calfhood vaccination (70% efficacy) beginning in 2000. Continued management efforts and calfhood vaccination (70% efficacy) would reduce seroprevalence to 23% in 2011. With calfhood vaccination and a vaccine efficacy of 25%, seroprevalence was predicted to drop from 50% to 40% by 2006. This would be a negligible to minor beneficial impact (0–4% lower seroprevalence rate) compared to alternative 1.

Impacts on Recreation

United States citizens and people from all over the world spend more than 9 million visitor days of recreation in developed sites of the Yellowstone area each year. In Yellowstone National Park, recreational visitation has grown by more than 25% in the last 14 years. As is common in most other western national parks, visitor use in Yellowstone is concentrated in the summer months, with 66% of the visitation in June, July, and August. By the year 2003, estimated visitation is expected to range from 3.6 million to 4.3 million visitors per year (NPS 1994a). An additional nearly 2.8 million recreation visitor days on the adjacent Gallatin National Forest were logged in 1992.

Wildlife and Bison Viewing. When Yellowstone National Park was set aside in 1872 as the world's first national park, the "wonders of the Yellowstone" were the primary motivation — spectacular geysers, colorful hot pools, and the Grand Canyon of the Yellowstone (Meagher 1974). However, in modern times, wildlife viewing is the primary activity for many visitors who come to Yellowstone National Park. Bison are ranked as one of the top 10 animals visitors hope to see on a visit to the park.

Increases and reductions in bison numbers in and around the park could directly affect visitor wildlife-viewing experiences. Alternative 1 would lead to a moderate growth in bison numbers over the next 10 years (42% increase in population by 2006). Alternatives 2 and 3 populations would be 14% greater than alternative 1 populations and lead to a minor to moderate increase in viewing opportunities. Alternative 4 would be expected to result in a population of 2,812 bison in 2006. This is 8% smaller than under alternative 1 and would lead to a minor decrease in viewing opportunities. Alternative 5 would lead to a 35% decrease in bison populations compared to alternative 1 by 2006 and a moderate to major adverse impact on associated viewing opportunities. Alternative 6 would lead to very similar populations as alternative 1 through 2009 until seroprevalence stabilizes from vaccination (estimated at roughly

10 years), then would reduce them temporarily by 17%, a minor to moderate adverse impact. Alternative 7 calls for the lowest long-range (15+ years) bison population of all the alternatives. By 2006, the population would be nearly 23% lower. These reductions in population size would likely lead to minor to moderate reductions in bison viewing opportunities relative to alternative 1.

Winter Recreation. Winter use in the park has been growing at an accelerating rate, nearly doubling in the decade between 1984 and 1994, to 140,000 in the 1994–95 winter season. An estimated 46% of winter visitors liked viewing the scenery most, and 17% specifically identified wildlife viewing as what they liked most about the park in the winter (NPS 1990b). In addition, snowmobiling has become a popular sport in the town of West Yellowstone.

Winter recreational use of Yellowstone National Park would be affected under alternatives 2, 5, and 6. Alternative 2 would lead to long-term closure of winter access to the park from the popular snowmobiling town of West Yellowstone and possibly restrict access from Mammoth to the park interior. Proposed alternative 2 road and trail closures would likely affect well over 50% of current winter oversnow visitors to the park, and either displace their activities to other roads and trails in the area or cause them to go to areas other than Yellowstone for winter recreation. Alternative 2 would likely have a minor to moderate effect on winter recreation users in the Yellowstone region. During the three to four years of capture and slaughter operations, alternative 5 would have a higher negative impact on winter recreation than alternative 2 in that the west, north, and east entrances would all be cut off from winter access to the popular Old Faithful area. For the first 10–12 years alternative 6 would have similar negative impacts on winter recreation to alternative 2. During the following two to three years, the impacts on winter recreation under alternative 6 would be similar to those for the capture and slaughter period of alternative 5.

Hunting. The five-week elk general rifle season in the study area takes place in late October and November. Mean harvest of elk in and near the affected environment is 3,044. By comparison, deer harvest is 2,564, moose is 93, bighorn sheep is 22, mountain goat is 10, and pronghorn is 23.

The American bison is a trophy animal for big-game hunters. Bison hunting takes place on both public lands and private game ranches in North America. Private ranches charge relatively high prices (ranging from $2,250 to $4,000 in the Northern Rocky region) for hunting a trophy-sized bull.

Limited hunting of bison would be allowed under alternatives 3, 4, and 7. Under alternative 3 between 75 and 85 bison hunting permits would be issued per year. Under alternative 4 the number of permits would be approximately 35. Under alternative 7 between 25 and 35 permits would be issued. This change in hunting opportunities in the area would represent a minor increase in overall big game hunting in the Greater Yellowstone Area, but would be a minor to moderate benefit for those receiving permits. No hunting of bison would occur under alternatives 1, 2, 5, or 6.

Impacts on Livestock Operations

In the Yellowstone area, the livestock industry is composed mainly of cow-calf operations with the exception of a few sheep producers. Cow-calf pairs are grazed on national forest allotments that can include adjacent private land, and on private holdings not associated with grazing allotments. In addition to risks of disease transmission, bison can harm livestock, as well as damage structures.

To the north of Yellowstone National Park, grazing allotments located in the broadest area included in this environmental impact statement have about 434 cow-calf pairs on national forest land and about 191 pairs on adjacent private land included as part of the allotments. When only the Reese Creek area is considered, cow-

calf pairs on national forest land number about 86, with about 130 pairs on allotted private land. In the West Yellowstone area, about 364 cow-calf pairs are grazed on national forest land in the Horse Butte and Wapiti areas. An additional 128 pairs (and 2 pairs on allotted private land) are found on allotments to the west and south of Hebgen Lake.

Cattle near Whitehall, Montana, by G. Wunderwald. (NPS photo)

Privately owned lands that are not part of allotments include both livestock holdings and nonranch residences. North of Yellowstone National Park, the largest of the livestock operations is in the Reese Creek area on the Royal Teton Ranch. It has about 100 cow-calf pairs on unallotted private land, in addition to 150 on allotted private and public land.

In the West Yellowstone area, there are four private holdings located in the Horse Butte region between Duck Creek and the Madison River, totaling about 1,250 acres. Only the largest, with an area of about 650 acres, has a summer cattle operation with about 215 cow-calf pairs. Including producers to the west and south of Hebgen Lake, there are an estimated 800 cow-calf pairs on private land in the West Yellowstone area that could be directly affected by the most extensive of the SMAs (alternative 2).

Altogether, publicly and privately grazed cattle to the north and west of Yellowstone that could be directly affected are estimated to total about 2,019 cow-calf pairs. They comprise less than 4% of the cattle population of Gallatin and Park Counties.

The impacts of brucellosis on livestock operations involve not only the area adjacent to Yellowstone National Park, but also producers throughout Montana. The threat of disease transmission and the economic effects of disease-exposed bison entering the state have potential impacts that could indirectly affect all producers in the state.

Under alternative 1, cattle producers near Yellowstone National Park currently take precautions against the threat of brucellosis by vaccinating all female calves. In addition, herds from Idaho that graze in the West Yellowstone area are tested both when entering and leaving Montana. The cost of vaccinating and testing is relatively minor, estimated at about 2% of average yearly cow-calf production costs in the western United States. Producers' perceptions of the potentially negative consequences of grazing near Yellowstone National Park underlie recent decisions by two purebred stock owners to no longer graze their cattle in the area.

Alternative 2, characterized by minimal bison management, would involve modification of grazing allotments on the national forest, acquisition or easement of private lands, and conversion of cow-calf operations to steer or spayed heifer production. In the short term, until these changes are accomplished, the interim plan would continue. Public funds would be required for compensating producers who agreed to convert their operations and for acquiring the title or use of the private properties. These transactions would be voluntary with fair remuneration. Nevertheless, they would represent major impacts for the producers involved. Modification of public grazing allotments could affect as many as 926 cow-calf pairs. Incidents of damage by bison would be similar to occurrences under alternative 1 until susceptible cattle were removed from the areas designated as SMAs. Afterward, incidents would be fewer, since the only cattle would be those on converted holdings. Producers near SMA

boundaries would likely continue to vaccinate female calves.

Under alternative 3, testing and vaccinating would continue as under the interim plan (alternative 1) in the short term. In the long term, modifications in grazing allotments on the national forest as described under alternative 2 would reduce the need for vaccinating and testing, but within less extensive SMAs. Producers near SMA boundaries would likely continue to vaccinate female calves. Whereas about 2,019 cow-calf pairs are found within the areas designated to be SMAs under alternative 2, the smaller areas of alternative 3 contain about 895 cow-calf pairs. Moderate to major impacts in the long term for these herds would result from possible conversion to steer or spayed heifer enterprises, closure or modification of grazing allotments, and private land acquisitions. Hunting could provide a minor source of income for remaining converted holdings.

Alternative 4 differs from alternative 1 in that bison hunting would be allowed. Hunting in the West Yellowstone area could provide a minor source of income for some private holdings.

Under alternative 5, livestock operators in the vicinity of Yellowstone National Park would likely perceive a reduced disease threat because no bison would be allowed outside the park. Restriction of bison to the park would lessen concerns over brucellosis transmission, although vaccination of cattle could continue, especially in the short term. Relaxation of testing practices in the West Yellowstone area would depend on changes in Idaho's agreement with Montana. Private grazing resources might increase in value due to reduced risks of disease spread and damage by bison. Thus, the overall impact on affected livestock producers could be moderately beneficial.

Consequences of alternative 6 with respect to testing and vaccinating would be the same as in alternative 1 during the first years of vaccination of Yellowstone bison. Once capture, test, and slaughter of bison were undertaken, consequences for livestock producers would be like those of alternative 5, although seronegative bison would be allowed on public land in the West Yellowstone SMA. Cattle vaccination would probably continue, depending on producers' risk perceptions. Continued testing of herds in the West Yellowstone area would depend on Idaho's agreement with Montana. In the long term, moderate benefits overall would be realized under this alternative, as under alternative 5.

SMAs under phase 1 of the preferred alternative (alternative 7) would be the same as they are now under the interim plan (alternative 1). Testing and vaccinating would continue, as would possible incidents of damage by bison within the boundaries of the SMAs. No modifications of livestock operations would occur under phase 1. In phase 2 (following acquisition of winter range north of the Reese Creek boundary), impacts could affect at least one private holding and could modify three public grazing allotments along the western side of the Yellowstone River in the Gardiner Valley.

In addition to direct impacts on local producers outlined above, ranchers throughout the state could suffer from increased testing or vaccinating requirements or interstate sanctions should brucellosis be transmitted to Montana cattle. The possibility of such transmission and associated indirect impacts would be considered remote in all alternatives, although it would be slightly less in alternative 5, slightly greater in alternative 2, and roughly equal in the remaining alternatives.

Impacts on Socioeconomics

Regional Economy. The affected area primarily encompasses two Montana counties, Park and Gallatin, and portions of Yellowstone National Park.

Throughout the Greater Yellowstone Area, public lands provide the basis for much of the economic activity in the region (recreation, mining, forestry, and agriculture). The area's overall economy has been changing for more

than 20 years. The economy has shifted from commodity-extraction dependence to a more diversified economy based on recreation, tourism, and service industries. For example, between 1969 and 1989, more than 96% of all new jobs in the Greater Yellowstone Area came from sectors other than timber, mining, and agriculture (Rasker, Tirrell, and Kloepfer 1992).

Approximately 10% of Park County employment and 5% of Gallatin County employment is in the agriculture, forestry, and mining sectors. In addition, some component of employment in manufacturing, wholesale and retail trade, and services is derivative of activity in these resource-based sectors. Most jobs pertaining to the recreation and tourism industry are found in the retail trade and service sectors of a county's economy.

Recreation and tourism are significant to the economic viability of the area. Retail trade and services accounted for approximately 40%–45% of each county's earnings. These sectors, along with the government sector, have a strong tie to the region's resources and would likely continue to be important in sustaining segments of the economy of the Greater Yellowstone Area.

The alternatives described in this environmental impact statement would have the potential to affect jobs and income primarily through changes in visitation levels to Yellowstone National Park. Visitation levels could be affected by changes in winter road grooming, changes in wildlife viewing as a result of lowered population levels of bison, or in response to tourism boycotts. Visitors to Yellowstone National Park from outside Montana, Wyoming, and Idaho spent an average of $840 during their trips (Duffield 1992).

Expenditures related to recreation — A 1994 report on snowmobiling in Montana found nonresidents spend approximately $40 million annually in the state, and three-fourths of those nonresidents spent time in or near West Yellowstone (Sylvester and Nesary 1994). If alternative 2, which would include closing roads now groomed for snowmobile use from West Yellowstone into the park was implemented, the annual loss in winter tourism expenditures in the town of West Yellowstone could be between $656,000 and $2 million. Under alternative 5 these regional annual losses could be $1.8 million to $3.2 million during the three to four years of road plowing (to pavement, and therefore unavailable for snowmobile use) for the capture and slaughter operations. Alternative 6 could lead to expenditure losses similar to those under alternative 2 for the first 10–12 years, and similar to those under alternative 5 for the next two to three years. The loss under all these alternatives would be substantially higher if not for considerable snowmobiling opportunities on the nearby national forest. Losses of winter recreation expenditures under alternatives 1, 3, 4, and 7 would probably be negligible. The adverse impacts on winter recreation expenditures under alternative 2 could be more than offset by positive impacts on visitation related to wildlife viewing (see below). The adverse impacts on winter recreation expenditures under alternatives 5 and 6 would be in addition to adverse impacts on visitation related to wildlife viewing.

Resident elk hunters spent $54 per day while resident deer hunters spent $41 per day. Nonresident hunters expenditures associated with elk and deer hunting are $252 and $115 per day, respectively (Duffield 1988). Expenditures related to bison hunting in alternatives 3, 4, and 7 would add to this base, by as much as $440 per day. Since a maximum of 85 hunting permits for any alternative would be expected, expenditures related to it would be only a negligible benefit to the regional economy.

Expenditures related to wildlife viewing — Alternatives 2 and 3 would increase bison viewing opportunities, and alternatives 5, 6, and 7 would reduce them. The beneficial impact on the regional economy from alternatives 2 and 3 from increased visitor expenditures could be $20 million in annual park area visitor spending. Conversely, the adverse impact from alternatives 5, 6, or 7 could be $20 million in lost revenues from tourism.

The management of bison would involve killing through agency shooting, transport of seropositive animals to slaughter, hunting, and other actions that some would find objectionable. People who do take offense might object for any number of reasons: e.g., the killing of any animals is inappropriate, human management of wildlife is not needed, or bison do not need to be controlled to prevent brucellosis transmission from bison to cattle. All alternatives would involve bison management, and thus each would have some potential for adverse public reaction that might result in the call for a tourism boycott, although the potential would likely vary among alternatives. The potential for such a call and the effectiveness of such a boycott would be difficult to judge.

Minority and Low-Income Populations. As of the 1990 U.S. census, Park County had a per capita income of $11,378, approximately equal to that of the state of Montana. Gallatin County had a substantially higher income level of $17,032 per person. The percentage of the population in poverty across the two counties and the state was relatively consistent in 1990 at between 15.2% and 17.1%. Unemployment in the two counties in 1994 was below the state average of 5.1% (Park County, 4%; Gallatin County, 2.3%).

Montana's Native American population had a much lower per capita income ($5,422) than either the two counties or the state, a much higher percentage of population living in poverty (46.1%) than the counties or the state, and an unemployment rate (26.2%) much higher than the counties or the state.

Several area tribes have expressed interest in receiving bison carcasses, or, more importantly, live bison as seed stock from the Yellowstone herd to begin their own bison operations. Bison meat sells for nearly twice the cost of beef because it is considered a health food by some consumers.

Under the interim management plan, a total of 1,084 bison were killed outside the park in Montana in 1996–97. Of this total, 590 bison were shot on the spot and donated to charities or released to Native Americans in exchange for the labor of gutting, cleaning, and transporting carcasses. Charities received 77 bison, and Indian tribes, tribal members, and affiliated organizations received 513 bison (State of Montana, C. Siroky, pers. comm. 1997).

Alternatives 1, 3, 4, 5, 6, and 7 all would include slaughter and the distribution of carcasses, and all alternatives would include provisions for shooting bison if they crossed boundary lines (and the subsequent gutting, cleaning, and distribution of carcasses, hides, and heads). The estimates for numbers of bison to be sold or donated for consumption would range from an incidental number per year in alternative 3 to 720 over four years under alternative 5. These numbers would represent a very minor portion of the total U.S. annual market for bison meat. The impact of charitable donations or release of carcasses to tribes would generally be negligible.

The release of live bison would require quarantining captured seronegative bison for the completion of a lengthy quarantine protocol. Quarantine facilities would be proposed for alternatives 3, 4, and 7, and live bison completing the procedure would be available to tribes and other requesting organizations. Live animals received after quarantine would have substantially more value to tribes than would carcasses.

Social Values. Bison are symbolically an icon for the independent, wild, and free American way of life, and are considered by some people to be "a unique symbol of the strength and determination of the people of North America" (National Bison Association 1997a).

Bison embody the culture of many native Plains peoples. They are a link to the spiritual world, spiritual power concentrated in physical form, the "great provider," and ultimately a symbol of power and strength. Bison skulls are used as altars, bone is used on traditional dress, and they are at the heart of the continuing sun dance.

Bison are important to other groups as well. To hunters, they are a trophy animal; to cattle ranchers, bison have historically represented competition with livestock for limited forage; and to many animal rights activists, they are an aesthetic and historic resource.

Written comments collected from the *Interim Bison Management Plan/Environmental Assessment* in 1995 indicated the public was strongly against the slaughter of bison. Ranchers also indicated strong feelings on the need to protect cattle from brucellosis. These are moralistic-humanistic and utilitarian values, respectively (see the "Socioeconomics" chapter, "Social Values" section of this document for definitions). No systematic surveys have been conducted, but it appears that alternatives relying on slaughter (1, 4, 5, 6, and 7) would have a minor to major adverse impact on those having strong moralistic-humanistic values toward animals.

Attitudes in the Yellowstone region would be more balanced between utilitarian and other attitudes than in the nation as a whole (based on wolf recovery information). Native American values may be more complex, as many of the management actions are viewed as disrespectful or wasteful of bison.

Nonmarket Values. People place value on knowing a species is maintained in a viable state or has been augmented in some way. In a study involving elk winter range north of Yellowstone National Park, those surveyed found the benefit of a land purchase to benefit elk far outweighed actual land acquisition costs. This "nonmarket" or "existence" value applies to bison as well, and although no studies specific to bison were conducted, alternatives 2, 3, and 7 could potentially have large nonmarket value benefits associated with expansion of bison winter range, on the order of $1.6 to $22.9 million annually. Additional nonmarket values attributable to the opportunities to view natural wildlife populations, or for recreational opportunities, could also be in the millions of dollars.

Social Cost-Benefit. From a social cost-benefit perspective, alternatives 2, 3, and 7 would have the potential to range from a moderate negative to a major positive impact, while alternative 4 would likely have a minor adverse to negligible impact compared to alternative 1. Alternative 5 would likely have a major adverse impact, and the impact on alternative 6 could range from minor to moderate adverse.

From a regional economic perspective, alternatives 2, 3, and 4 would likely have a negligible to minor positive impact, while alternatives 5 and 6 would have a minor to moderate adverse impact. Regional economic impacts under alternative 7 would be expected to range from a moderately adverse effect to a minor positive impact.

Impacts on Threatened, Endangered, and Sensitive Species

Peregrine falcons, bald eagles, grizzly bears, and gray wolves are the only known species to occur within the affected area that are protected by the Endangered Species Act. Wolverine, lynx, and trumpeter swan, USFS sensitive species, could also occur in the affected area. These species could be directly affected by bison management actions, such as shooting, hazing, or habitat loss or modification. Because bison are an important food source, predatory species could also be indirectly affected by reduced foraging opportunities caused by changes in bison numbers, distribution, and seasonal migration patterns.

Peregrine Falcons. The alternatives would have no effect on peregrines because bison management activities would not occur near active aerie or foraging areas, and because they do not feed on bison carrion.

Bald Eagles. Alternatives 5 and 6 would negatively affect bald eagles that winter and nest near Seven-Mile Bridge because of the location of a capture facility in this area. Other bald eagles in the analysis area would be protected by avoiding their nesting and wintering areas. Change in bison carrion availability would have a negligible effect because it is only a small part of the bald eagle diet.

Grizzly Bears. All alternatives could potentially disturb or displace grizzly bears from areas near bison management activities. The alternatives would affect only a small part of the Greater Yellowstone Grizzly Bear Recovery Zone, an area where seasonal or year-long grizzly activity is common and contains habitats important to the recovery of grizzly bears. Denning bears would not be affected during the winter when most activities would occur. Under alternatives 3, 4, and 7, increased human activity could increase the probability for human/bear conflicts and bear mortality. This probability would be reduced to negligible by educating hunters, removing gut piles, and implementing other mitigating measures.

The degree to which an alternative modifies bison population numbers could likewise affect grizzly bears. Bison, along with other ungulates, rank as one of the highest sources of net digestible energy for grizzly bears in the Yellowstone ecosystem. Data indicate that 32% of all meat in the diet is carrion, and most of that is from adult bison. Bison are particularly important to bears because they provide a high quality food source during early spring before most vegetal foods are available to bears. Grizzly bears that den in the Pelican and Hayden Valleys in the park depend on bison carrion and are most likely to be affected by changes in bison populations.

Under alternative 1, bison numbers would not be maintained within a specific range, and low population levels could result during some periods. Consequently, foraging opportunities could be reduced during some years and negatively impact grizzly bears, particularly during the spring. This impact would likely be negligible unless bison disappeared from Pelican or Hayden Valleys in the park. Alternative 2 would allow the bison population to reach a long-term maximum of 3,500 bison quickly, and would leave park roads ungroomed, which would likely increase winter bison mortalities and carrion in the park. This would increase the availability of bison as a food source and moderately benefit grizzly bears. Alternative 3 would have minor benefits. Alternatives 4, 6, and 7 would maintain the bison populations within a specific range and cause only minor changes in the population. Thus, the impacts on grizzly bear foraging opportunities would be negligible. Alternative 5 would cause a major decrease in the first few years in the bison population and reduce the carrion supply available to grizzly bears.

Gray Wolves. The Rocky Mountain gray wolf was reintroduced in Yellowstone National Park in March 1995 and is part of a "nonessential experimental population." This means that the species is listed and protected under the Endangered Species Act, but agencies have additional flexibility in their management. To date nine packs are in the Greater Yellowstone Area, mostly in the park. Some individuals and packs have made exploratory movements outside the park, but none is resident outside the park.

All alternatives could disturb or displace wolves from areas near bison management activities. However, any impact on the small wolf population would likely be negligible.

Wolves prey primarily on elk, moose, and deer. These species are abundant in the analysis area, and usually account for more than 90% of the biomass consumed. Smaller mammals may be an important alternative food during the snow-free months. Wolves rarely prey on live bison, but do eat bison carrion if it is available. Although

wolves could eventually increase their take of bison as prey as the wolf population increased, impacts from changes in the bison population during the 15 years this plan was in effect would be negligible in alternatives 1, 3, 4, 6, and 7. Alternative 2 would have a moderate beneficial impact and alternative 5 a moderate to major adverse impact to wolves through larger-scale changes in bison population numbers.

On December 12, 1997, the United States District Court for the District of Wyoming ruled that the gray wolf reintroduction program in Yellowstone National Park and northern Idaho violated one provision of the Endangered Species Act. The court ordered the federal government to remove the reintroduced wolves and their offspring. The court stayed the effect of the order pending appeals. Because the decision is on appeal, this document considers the gray wolf as a permanent component of the study area. Should the decision be upheld on appeal and the wolves were removed, impacts on the gray wolf would not be an issue associated with bison management under the alternatives analyzed.

Wolverine and Lynx. Both wolverine and lynx are very susceptible to human activities, and wolverines readily abandon den sites when disturbed. All the alternatives could displace or disturb wolverine and lynx from areas near bison management activities. Under alternatives 2, 5, and 6, snowmobile use now on the groomed trails inside the park would be displaced to trails and off-trail areas in the neighboring Gallatin National Forest where wolverine and lynx occur. Lynx are specialized predators that may face competition from generalist predators given access to their habitat by following packed-snow routes such as those resulting from snowmobile use. Winter recreation activities would be monitored on the national forest and, if necessary, mitigating measures implemented to protect the wolverine and lynx. Changes in bison numbers would have a negligible impact because wolverine and lynx seldom feed on bison carrion.

Trumpeter Swans. Trumpeter swans could be affected by the location and operation of bison management facilities. The swan occupies meadows and open fields, plus lakes, ponds, or slow-moving water inside the park on the Madison River. In particular, a breeding pair at Seven-Mile Bridge where a capture facility is proposed in alternative 6, would experience major adverse impacts from construction and operation.

Impacts on Other Wildlife Species

Ungulates. The Stephens Creek capture facility occupies 13 acres of critical pronghorn winter range, and has had adverse impacts on the antelope population through displacement, disturbance, and blocked movements. Observations from capture operations during winter 1996–97 showed pronghorn avoided using habitat in the capture facility area, and some pronghorn may have been confused by the wing fences when fleeing from predators. The capture facility at Stephens Creek would continue to exist in all alternatives except alternative 2 (in the short term only in alternatives 3 and 7), and would have a moderate to major adverse impact on the pronghorn population. Other capture facilities, such as those in West Yellowstone and planned for different locations within the park in alternatives 5 and 6, could have minor adverse impacts on wildlife through displacement and disturbance.

Potential acquisition of additional wildlife winter range in the Gardiner Valley, a part of alternatives 2, 3, and 7, would make more winter habitat available to elk, mule deer, bighorn sheep, and particularly pronghorn. This would be a minor benefit to most ungulates and a moderate to major beneficial impact on pronghorn.

Occasional hazing operations associated with all alternatives would be expected to have minor impacts on elk, mule deer, bighorn sheep, and other ungulates through disturbance and temporary displacement.

In alternatives where snowmobile use would be displaced outside the park (alternatives 2, 5, and 6), impacts on ungulates outside the park could be more intense than they are now. This is because snowmobiles would be restricted to trails inside the park, but allowed to travel off trails in many areas of adjacent public lands.

Elk, pronghorn, deer, bighorn sheep, and moose would not likely be affected through competition for forage or space with bison, as each has an ecological niche that differs from bison through food choices, occupied habitat, or tolerance of snow depth. Therefore, increases or decreases in the bison population size would not be expected to affect any other large ungulates.

Predators and Scavengers. Hazing activities directed at moving bison into capture facilities or inside the SMA boundary could disturb and displace predator and scavenger species, including black bear, mountain lion, coyote, fox, wolverine, bobcat, lynx, and a variety of smaller mammalian and avian carnivores and scavengers using those areas. Hazing should be infrequent, however, and displacement and stress would be local and temporary and would have only minor effects on those populations. Changes in the bison population size and resulting availability of carrion would not affect predators and scavengers except during the parkwide capture and slaughter phases of alternatives 5 and 6, when reductions would be severe enough to cause a moderate impact. Displaced snowmobile use associated with alternatives 2, 5, and 6 might affect some of these species more severely than at present, as this activity is restricted to trails inside the park and might not be if it was displaced outside the park. Impacts on some species could be moderate.

Impacts on Human Health

Brucellosis is a zoonotic disease that can infect people, causing undulant fever. Symptoms include intermittent fever, chills, night sweats, body and joint pain, poor appetite, and weakness. The general public would be at no risk of contracting the disease from bison. However, people responsible for carrying out proposed bison management actions such as capturing, vaccinating, gutting, loading for slaughter, and laboratory analysis, could be at moderate risk. Hunters could also be at some risk. Recipients of auctioned or donated meat could be at minor risk of exposure through the handling of potentially contaminated meat and the consumption of improperly prepared meat. Proper handling and cooking completely kills the bacteria.

Mitigating and preventive measures, such as proper equipment, ventilation, and information, would prevent impacts from being more than negligible to minor in all alternatives except during the parkwide capture and slaughter phases of alternatives 5 and 6, when the risk would be minor to moderate.

Impacts on Cultural Resources

The Great Plains and the northern Rocky Mountains of western Montana and Wyoming served as feeding grounds for bison. This region is also the homeland of various native peoples who hunted these herds.

Bison were critical to the indigenous cultures of North America and were an important part of the landscape covering over half the continent. They once ranged from the Appalachian Mountains to the "deserts" of the Great Basin south into Mexico and as far north as the Yukon territory in Canada. English settlers arriving in what is now Georgia wrote of the "innumerable" bison they encountered. The numbers were so great that early Euro-American explorers could only describe them as "numberless," and wrote that the plains were "black and appeared to be moving" with the herds of bison. The most commonly used estimates of their numbers were between 30 and 65 million.

Illustration entitled "By the Millions" by Martin S. Garretson, 1913. (NPS photo)

Bison provided not only food, clothing, fuel, tools, and shelter, but also were central to Plains tribal spiritual culture, viewed as an earthly link to the spiritual world. For many tribes, bison represent power and strength. For example, the Shoshone believe that spiritual power is concentrated in the physical form of the bison. Many contemporary tribes maintain a spiritual connection with bison. Today, the InterTribal Bison Cooperative describes itself as "tribes proudly serving the buffalo nation," indicating respect and a sense of equality and direct spiritual connection.

Traditional use of bison by humans centers on hunting and is evidenced in the archeological record. The remains of game drives, including both the fences and bison jump sites, as well as chipping stations, wickiups, and weapons, are all associated with the importance of hunting bison for tribal economy and culture.

Most archeological sites in the Yellowstone area have not been evaluated according to the National Register of Historic Places criteria, although Obsidian Cliff, an area particularly rich in cultural remains, has been nominated as a national historic landmark. Several others, including the Yellowstone road system, one archeological site in the Stephens Creek area, and one archeological site in the Eagle Creek area, are considered to be eligible for inclusion in the national register.

In all alternatives, bison would be killed while occupying their historic range. Reductions in the population size compared to the no-action alternative (alternative 1) would occur on a short-term basis in alternatives 5 and 6, might occur on a short- term basis in alternative 4, and would occur on a long-term basis in alternative 7.

In all alternatives except alternative 2, the process of monitoring and vaccinating bison would change their appearance. Bison would be marked with visible metal ear tags, paper back tags, and paint/peroxide stripes to indicate to managers and others that they have tested negative for the *Brucella* organism. These actions alter the historic image of the bison and would have a temporary, moderate impact on the historic landscapes.

The construction of new capture or quarantine facilities would have the potential to affect archeological resources. In all alternatives proposing construction of bison management

facilities (all except alternative 2), site-specific surveys would be conducted prior to ground-disturbing activities, and every effort would be made to avoid known archeological resources. Should avoidance prove impossible, the National Park Service, U.S. Forest Service, and state agencies would develop mitigating measures in consultation with the state historic preservation officer and the advisory council. Therefore, the impact would likely be minor.

Removal of the capture facility at Stephens Creek, as proposed in alternative 2, would have a beneficial impact on the historic landscape. The construction of several new capture facilities in alternatives 5 and 6 would have a temporary but significant adverse impact on the historic landscape of Yellowstone National Park.

Impacts on Visual Resources

Visual resources consist of landform (topography and hydrology) and land cover (vegetation, buildings, roads, etc.). Visual resources are centered on significant features and intrinsic features. Also included is visibility of the undertaking, such as exposure and location.

The Greater Yellowstone Area is world renown for its scenery, wildlife, wilderness, rivers, fishing, hunting, outdoor recreation opportunities, and geologic and thermal features. The natural landscape is rugged and formidable due to the rapid gains in elevation, and most of the area remains in a wilderness state. Bison and other wildlife are frequently observed meandering through the landscape.

Visual resources within Yellowstone National Park fall into two general zones — the natural zone and the park development zone. Bison are observed within both, although they are most frequently observed within the natural zone.

Vehicle pullouts in the park are designed for visitors to stop and experience the visual resources, and are placed in areas where bison are most frequently found — e.g., valley lowlands off the main loop roads. Some locations include the open areas within Hayden Valley, Old Faithful/Firehole area, the Madison River (past Seven-Mile Bridge), Indian Creek in the Mammoth area, the Norris Campground, Gibbon Meadows, Elk Park, and others. The view from these pullouts includes an unobstructed natural setting containing habitat desirable to bison as well as other wildlife species.

The process of capturing and/or vaccinating bison would temporarily change their natural appearance. Bison would be visibly marked with tags and peroxide stripes due to vaccination and testing procedures. These processing marks would detract from the natural appearance of the animal. This would be a short-term, moderately adverse impact on the viewer, photographer, and anyone interested in seeing bison. Capture would be a part of all alternatives except phase 2 of alternative 2.

Agency shooting of bison and some hazing operations would be visible if bison ventured beyond delineated management areas. Hunting of bison outside the park in designated SMAs is also part of alternatives 3, 4, and 7. These bison management actions would have a minor to major short-term (winter only) visual impact on the landscape, or on some viewers, who might be opposed to shooting, hunting, or hazing bison, or might be sensitive to these activities.

The existing capture and test facility would continue to intrude on the viewshed at Stephens Creek in all alternatives except alternatives 2, 3, and 7. Because this facility is of a compatible design with the nearby Yellowstone National Park wrangling facilities, the impact on visual resources would be minimal. Also, this facility would not be readily visible to the majority of visitors to the park and surrounding areas.

Capture and test facilities within the viewshed on the western boundary of Yellowstone National Park would continue to adversely impact visual resources in alternatives 1, 4, 6, and 7. The visual impact of capture facilities at West Yellowstone would be minor to moderate. These facilities would not be visible in major

viewsheds, but some park visitors, national forest users, and local residents would see them. Bison management actions, such as hazing, shooting, and gutting, could be a major adverse visual impact on some of these viewers. Construction of capture and testing facilities in the Seven-Mile Bridge viewshed near the western boundary of the park in alternative 6 would be a major impact on visual resources.

The proposed construction of capture and test facilities within Yellowstone National Park at the Lamar Valley/Crystal Bench, Blacktail Plateau, Madison River, West Yellowstone boundary area, Old Faithful/Firehole River, and Hayden/Pelican Valleys, which is part of alternatives 5 and 6, would have a major impact on visual resources. These areas are highly sensitive to visual intrusions, and while measures would be taken to minimize impacts, the presence of these facilities would be highly noticeable.

A quarantine facility is part of alternatives 3, 4, and 7. Although the location or design of a quarantine facility for bison has not been determined, the facility would probably appear as large-scaled corrals and pens within which bison would be visible. Siting of a relocated capture facility and a new quarantine facility would be sensitive to views and features of the viewshed; therefore, impacts are expected to be minor.

In alternatives 2, 3, or 7, grazing allotments might be modified and could cause negligible to minor changes in the rural landscape near park boundaries. In the long term, cattle grazing would be modified in some allotments on lands adjacent to Yellowstone National Park, and the scenery would change to views of bison and wildlife habitat.

Changes in the size of the bison population would affect viewers. Some would find increased opportunities to view bison a benefit; others opposed to wildlife management policies would be adversely affected.

Alternatives 2, 5, and 6 include provisions for closing roads to snowmobile traffic. This would help restore the winter visual scene inside the park to a more natural one, but would adversely affect visual resources on adjacent Gallatin National Forest where much of the snowmobile traffic would be displaced.

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The Alternatives

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Consultation and Coordination

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PURPOSE OF AND NEED FOR ACTION

INTRODUCTION

The "Purpose of and Need for Action" part of the draft environmental impact statement (EIS) explains why the document is being developed. It describes the EIS planning process, details the need for action, provides background on why action is required, and identifies the specific purpose, objectives, and constraints in taking action. It also outlines the public input received to date on the bison management plan, including additional objectives, alternatives, or environmental issues the public has asked that this environmental impact statement analyze. A summary of all environmental issues analyzed, including those from the public, and an explanation of why some have been dropped from further analysis, concludes this part of the document.

PROPOSED ACTION

The National Park Service (NPS), the U.S. Forest Service (USFS), the Animal and Plant Health Inspection Service (APHIS), and the state of Montana have proposed several options for the interagency, long-term management of Yellowstone area bison to ensure domestic cattle in portions of Montana adjacent to Yellowstone National Park are protected from brucellosis, a disease that some of these bison carry, and to ensure the viability of the bison herd. Each option requires the cooperation of all agencies as all have jurisdiction over a portion of the management effort, either directly or indirectly. Members of these agencies working on this environmental impact statement are referred to as the "interagency EIS team," "interagency team" or simply "agencies" throughout the document.

The management actions proposed for evaluation in this environmental impact statement were developed with consideration for the current authorities of these cooperating agencies and information relevant to the management of the bison herd that periodically migrates across their jurisdictional boundaries.

Management decisions that are made pursuant to this environmental impact statement would remain in effect until the purpose of the plan has been achieved (see "Purpose of Action"); agency authorities change; or, new information, gained through implementation of those decisions, suggests a need for change. Future decisions to revise bison management procedures will be supported with additional NEPA analysis if necessary. For purposes of analysis, this environmental impact statement assumes that the selected alternative will remain in effect for 15 years.

PROJECT LOCATION

This project involves the northern Rocky Mountains of the United States, specifically Yellowstone National Park and an area of private, state, and federal lands in Montana to the north and west of the park boundary (see Region map). The study area is within what is known as the Greater Yellowstone Area or GYA (see the Greater Yellowstone Area and Study Area maps).

THE ENVIRONMENTAL IMPACT STATEMENT / PLANNING PROCESS

The first step in any planning process is to completely define the problem. In this case, the involved agencies must agree on why action is required. Members of the interagency EIS team are specialists in different fields relevant to the management of bison, cattle, and/or brucellosis, and have composed the need for action statement below as a brief synopsis of the problem they are attempting to solve by proposing action. A more in-depth discussion of the need for action is presented later in the "Background" chapter.

The interagency team also identified the general and specific purposes or goals it felt the action must accomplish to be successful. The general

goal is stated in the purpose section below, and the specifics are presented in the "Objectives and Constraints" chapter under "Objectives in Taking Action." The interagency team agreed these objectives would apply to all alternatives, as well as to the selection of a preferred alternative. Any alternative unable to meet one or more of the nine objectives to some degree would be eliminated as unreasonable.

The same was true for any alternative that did not comply with the legal or regulatory mandates of each agency. These mandates are identified in the "Constraints in Taking Action" section.

Public input on additional objectives, as well as on environmental issues and alternatives, was gathered in scoping and document review sessions described in the "Scoping Process and Public Participation" chapter. A more detailed description of public participation is in part 5 of the document, "Consultation and Coordination."

The interagency team then used objectives, constraints, and input from the public to devise a set of alternatives it felt covered the full spectrum of viable options. All were legally implementable and met objectives to some degree. None was considered to have such severe environmental, technical, or economic impacts or constraints as to be considered infeasible. All were distinct enough from each other to be separate alternatives. A description of each of the seven alternatives, as well as summary comparisons of the features and impacts of each, is found in part 2 of the document, "The Alternatives."

The environmental impacts of each alternative were analyzed and compared to existing conditions. A summary of this information is presented in part 3, "Affected Environment," and part 4, "Environmental Consequences."

This environmental impact statement has both policy, or programmatic elements, as well as site-specific elements. Bison range over most of the 2.2-million-acre park, as well as into areas outside the park. Management actions may affect distribution of bison within this area, or may cause regional changes in one or more of the resources analyzed. These are discussed primarily qualitatively, and since they occur over such a large scale, impact analysis is less precise. Conversely, impacts of specific management actions at a capture facility, or the impacts of locating a new capture facility (such as at Seven-Mile Bridge) are discussed in more site-specific detail. Because some choices are by design policy or program ones, additional site-specific environmental impact analysis may be required to implement them at some future date. For instance, the construction and operation of a quarantine facility on federal land or built with federal money, should quarantine be a selected management strategy, would be analyzed in a subsequent document. That document would be prepared, as is this one, to comply with NEPA requirements, and would be tiered to this environmental impact statement. This means the policy guidance derived from this environmental impact statement would apply to the subsequent analysis, and agencies would not evaluate nonquarantine options. Rather, they would focus on sites, designs, operation choices, etc., for the facility.

Information in this environmental impact statement was used by decision makers from the interagency team to help in selecting a preferred alternative from the alternatives analyzed. When the time period for public review has ended, the interagency team will revise the environmental impact statement to respond to comments and update and refine the document. The final environmental impact statement, together with public input, advice from staff, and economic, technical, and other information, will form an information base to be used by decision makers in selecting an alternative for implementation. This choice will be reflected in the final environmental impact statement and formalized in both federal and state records of decision.

OTHER ONGOING PLANNING EFFORTS

Bison management is only one of many management issues in Yellowstone National Park. Ongoing planning on these issues may

REGION

Yellowstone National Park

United States Department of the Interior • National Park Service

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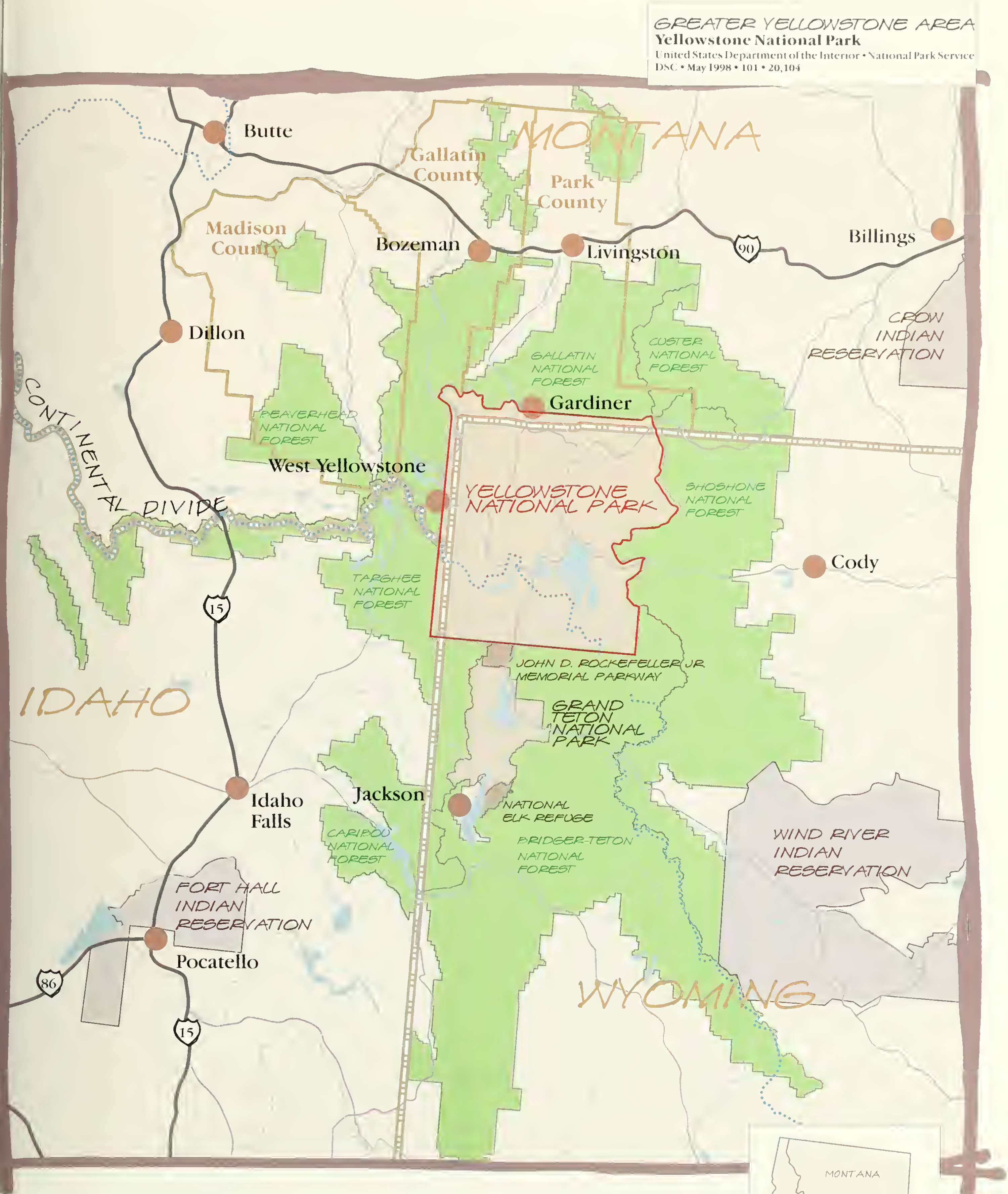
GREATER YELLOWSTONE AREA
Yellowstone National Park
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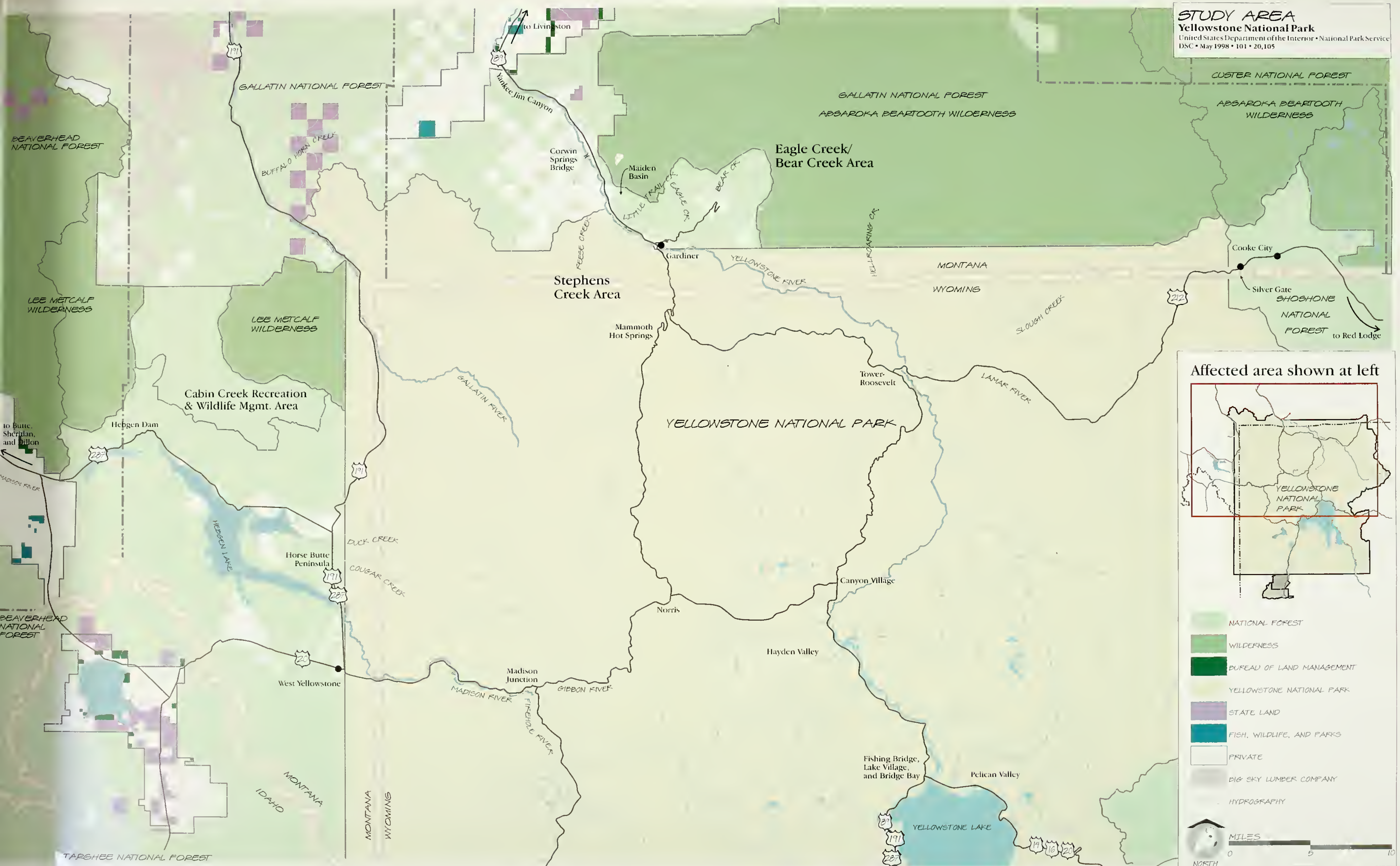
MONTANA
Butte
Gallatin County
Park County
Madison County
Bozeman
Livingston
90
Billings
Dillon
GALLATIN NATIONAL FOREST
CUSTER NATIONAL FOREST
CROW INDIAN RESERVATION
Gardiner
CONTINENTAL DIVIDE
BEAVERHEAD NATIONAL FOREST
West Yellowstone
YELLOWSTONE NATIONAL PARK
SHOSHONE NATIONAL FOREST
Cody
15
TARGHEE NATIONAL FOREST
JOHN D. ROCKEFELLER, JR. MEMORIAL PARKWAY
IDAHO
GRAND TETON NATIONAL PARK
Idaho Falls
Jackson
NATIONAL ELK REFUGE
CARIBOU NATIONAL FOREST
BRIDGER-TETON NATIONAL FOREST
WIND RIVER INDIAN RESERVATION
FORT HALL INDIAN RESERVATION
Pocatello
86
WYOMING
15
NO SCALE
NORTH


MONTANA
IDAHO
WYOMING
UTAH
COLORADO



STUDY AREA
Yellowstone National Park
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CUSTER NATIONAL FOREST
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
ABSAROKA BEARTOOTH WILDERNESS
Eagle Creek/ Bear Creek Area
to Livingston
Yankee Jim Canyon
GALLATIN NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
BUFFALO HORN CREEK
Corwin Springs Bridge
Maiden Basin
LITTLE TRAIL CR.
EAGLE CR.
BEAR CR.
HELLROARING CR.
REESE CREEK
Gardiner
YELLOWSTONE RIVER
MONTANA
WYOMING
Cooke City
Silver Gate
SHOSHONE NATIONAL FOREST
to Red Lodge
Stephens Creek Area
LEE METCALF WILDERNESS
LEE METCALF WILDERNESS
Mammoth Hot Springs
SLOUGH CREEK
Cabin Creek Recreation & Wildlife Mgmt. Area
GALLATIN RIVER
Tower-Roosevelt
LAMAR RIVER
to Butte, Sheridan, and Dillon
Hebgen Dam
MADISON RIVER
YELLOWSTONE NATIONAL PARK
HEBGEN LAKE
DUCK CREEK
Horse Butte Peninsula
COUGAR CREEK
Canyon Village
Norris
BEAVERHEAD NATIONAL FOREST
Hayden Valley
West Yellowstone
Madison Junction
MADISON RIVER
GIBBON RIVER
FIREHOLE RIVER
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
MONTANA
IDAHO
MONTANA
WYOMING
YELLOWSTONE LAKE
TARGHEE NATIONAL FOREST
Affected area shown at left
YELLOWSTONE NATIONAL PARK
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
MILES
0
5
10
NORTH

ultimately affect or guide the decision made on bison management. Therefore, the decision on bison management will need to be coordinated with other ongoing planning efforts. In addition, pursuant to the settlement of litigation, Yellowstone National Park and Grand Teton National Park anticipate commencing a plan and environmental impact statement for winter visitor use management. The parks should commence scoping on that plan in spring 1998. Yellowstone National Park is also preparing a commercial services plan that should be completed in 1999. As the agencies make decisions on these various processes, they will need to consider existing decisions and, perhaps, revise those decisions.

The U.S. Forest Service's *Gallatin National Forest Plan* (1987) would also be considered in ongoing planning efforts.

NEED FOR ACTION

Bison are an essential component of Yellowstone National Park and the Gallatin National Forest because they contribute to the biological, ecological, cultural, and aesthetic purposes of the park. However, Yellowstone National Park is not a self-contained ecosystem for bison, and periodic migrations into Montana are natural events. Some bison have brucellosis and may transmit it to cattle outside the park boundaries in Montana (see "Background"). As bison migrate out of the park and into Montana, they move from one jurisdiction with management objectives to another jurisdiction with different management objectives.

Therefore, the cooperation of several agencies is required to fully manage the herd and the risk of transmission of brucellosis from bison to Montana domestic cattle.

PURPOSE OF ACTION

The purpose of the action (that is, the bison management plan) is to maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana.

Bison migrating outside Yellowstone National Park.

THE YELLOWSTONE AREA BISON HERD

Bison are native to the Greater Yellowstone Area, and were observed there by early travelers before and after the creation of Yellowstone National Park in 1872 (see the Historic Bison Range map). In the 1870s and 1880s, the North American bison was driven nearly extinct by market hunting. In 1880, after a decade of intensive market hunting (for elk, bison, and other large mammals) in the park, the superintendent reported three herds totaling about 600 animals (Schullery and Whittlesey 1992). Over the next 15 years, this number was substantially reduced by poaching, but improved policing of the park by the U.S. Army (after 1886), combined with strengthened legal protection (after 1894), prevented complete elimination of park bison (NPS, Meagher 1973).

In 1902, 23 bison were counted in the native Yellowstone herd (see also "History of Bison in Yellowstone National Park" section in the "Affected Environment, Bison Population" chapter). Fearful the small wild herd might vanish, park managers imported 21 bison from captive herds in Montana and Texas into the park. These bison were raised using livestock techniques on the "Buffalo Ranch" in Lamar Valley. They were fenced, fed, vaccinated, and separated for shipment to slaughter. Between 1915 and 1920, intermingling of this captive herd and the remaining wild herd began, and by 1930, bison wintering in the Lamar area numbered more than 1,000 (Keiter and Forelicher 1993).

In the 1930s, the National Park Service gradually began efforts to restore the bison to a more natural distribution (NPS, Meagher 1973). However, herd reductions to achieve range management goals and other manipulation of the population continued from the 1920s until the late 1960s, and were often quite intensive. The highest reported bison count during this period was 1,477 in 1954.

In 1967, when bison population controls ceased, 397 bison were counted in the park. At that time, as part of a larger redirection of park policies, ungulate herd reductions ceased. Bison, elk, and other animals were allowed to reach population levels primarily affected by environmental conditions. As the population has grown since the late 1960s, more bison have attempted to move to ranges outside the park, particularly in harsh winters. However, past data demonstrate that the number of bison moving beyond Yellowstone boundaries is highly variable from year to year, and show no strong or discernible correlation with population size. This means bison may not move outside the park even at high population numbers. Conversely, large numbers of bison may leave when population numbers are low if winter conditions prevent access to forage. During a given stochastic or periodic event such as a severe winter, it is likely that more bison would leave the park if population sizes are larger.

In 1968, in response to livestock industry concerns over the disease brucellosis, the National Park Service proposed a program to control bison at the boundary of the park. The program relied on shooting bison that approached or passed beyond park boundaries and could not be deterred from leaving the park.

As early as the winter of 1975–76, National Park Service and Montana Department of Fish, Wildlife and Parks personnel experimented with hazing, herding, baiting, physical barriers, and scare devices in order to discourage bison from leaving the park. Barriers and harassment were found ineffective in preventing bison movement (Meagher 1989a).

Shooting bison had been regarded as a last resort in management but became more necessary as time passed. Three bulls were shot in 1974, and one was shot in 1978. In 1978 approval for park personnel to shoot bison inside park boundaries was rescinded, unless human safety was

HISTORIC BISON RANGE

Yellowstone National Park

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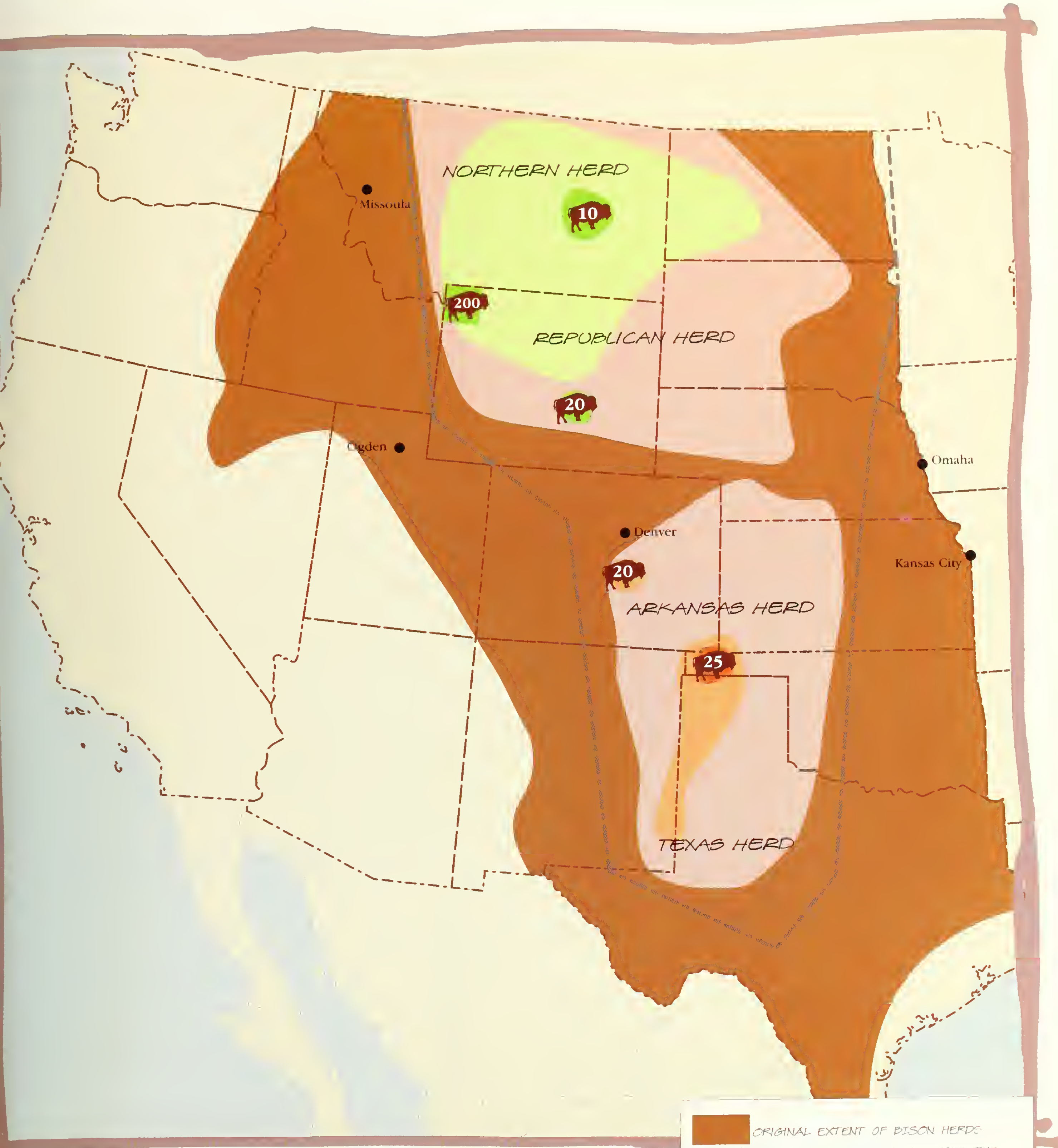


ORIGINAL EXTENT OF BISON HERDS

APPROXIMATE BOUNDARY BEFORE THE SYSTEMATIC DESTRUCTION OF THE BUFFALO FOR ROBES AND HIDES

APPROXIMATE RANGE OF THE TWO GREAT HERDS IN 1870

APPROXIMATE RANGE OF THE SOUTHERN HERD IN 1875 / 1889

APPROXIMATE RANGE OF THE NORTHERN HERD IN 1880 / 1884

25 APPROXIMATE NUMBER OF BISON LEFT BY JANUARY 1889

NO SCALE

NORTH

HISTORICAL ATLAS OF THE AMERICAN WEST
BY BECK AND HAASE

threatened (Meagher 1989b). This authority was later returned in the 1995 *Interim Bison Management Plan.*

In 1984, Montana wardens killed 88 bison outside the park. In 1985 the Montana Legislature authorized public hunting to remove bison that migrated from Yellowstone National Park into Montana. In the next three winters, 99 bison were killed after leaving the park, mostly by hunters. In the winter of 1988–89 following a summer drought and areawide fires, a much larger migration out of the park on the north side resulted in the removal of 569 bison. Most of these were killed by hunters, and the rest were taken by wardens or park rangers. In 1991, due to public controversy over the large number of bison killed during the 1988–89 season, the Montana Legislature removed the authorization to hunt bison in Montana.

The number of bison grew to a peak population of more than 4,200 animals as of July 1994, and declined to a high count of 3,436 in September 1996. In 1996–97, a particularly harsh winter with deep snow and ice sent hundreds of bison toward park boundaries, seeking exposed forage at lower elevations. With capture, slaughter, and other agency-maintained boundary control measures in place, the migration meant the slaughter or shooting of 1,084 bison in the five months between November 14, 1996, and April 15, 1997. This, added to losses from natural causes like extreme weather, winter kill, and starvation, brought the total population down to an estimated 2,000 animals.

BRUCELLOSIS IN THE YELLOWSTONE BISON HERD

The first known positive serologic test for brucellosis in the bison herd was reported in 1917. *Brucella abortus* was introduced to North America with imported cattle. *Brucella* organisms isolated from bison are identical to those that cause brucellosis in cattle (see "Brucellosis in Cattle and Bison"). While it is unknown exactly how and where the original transmission to bison occurred, it is presumed that bison acquired the disease directly or indirectly from domestic livestock.

Cattle were grazed inside Yellowstone National Park from 1886 to 1917, and included beef and dairy herds run by concessioners in support of restaurants and hotels or tent operations (Whittlesey 1994; Meagher and Meyer 1994). Permits were granted to pasture cattle at seven different locations around the park, many in the same location as bison, particularly those on the Buffalo Ranch. In addition, bison calves from the wild population were captured and fed cows' milk around the turn of the century. Some of the bison that were imported to the park in 1902 originated from a brucellosis-affected bison herd (Don Ferlicka, pers. comm.), and the Texas herd had been closely associated with cattle. Bison from the Texas herd were exported to the Moiese Bison Range, Elk Island, and Yellowstone National Park. Subsequently, brucellosis was discovered in each of these herds.

It does not appear that brucellosis is a threat to the long-term survival of park bison. Although brucellosis-related abortions are known to occur, studies have demonstrated that the park bison population has been generally increasing, in spite of the disease and intermittent control actions outside the park, for the last 30 years.

In 1997, the secretary of the interior commissioned the National Academy of Sciences (NAS) to complete a report on brucellosis in the Greater Yellowstone Area. In December 1997, the National Research Council of the National Academy of Sciences issued a prepublication draft, "Brucellosis in the Greater Yellowstone Area."

The agencies have not referenced or cited the NAS report because it is in preliminary form. The NAS report will provide further information on topics addressed by this draft environmental impact statement. When the NAS report has been finalized, the agencies fully anticipate reviewing and utilizing it where appropriate in writing the final environmental impact statement. The NAS report will be widely

distributed to the public, placed in libraries, and put on the Internet (http://www.nas.edu/).

BRUCELLOSIS IN CATTLE AND BISON

One of the most difficult aspects of developing a management plan for the wild, free-ranging bison that migrate from Yellowstone National Park is that some animals in this herd are infected with *Brucella abortus*. This organism causes the disease brucellosis, which can occur in humans, domestic livestock, bison, elk, and other mammals. Within the scientific community and among the people who are interested in bison management, there are differing opinions about the appropriateness or necessity of a management emphasis on the control or elimination of *B. abortus*, the environmental consequences of actions necessary to control or eradicate the disease, and the consequences of not controlling or eradicating brucellosis from this bison herd.

Given the controversy about brucellosis in wildlife, the Greater Yellowstone Interagency Brucellosis Committee (GYIBC) developed and approved at its April 1997 meeting a paper entitled "Brucellosis in the Greater Yellowstone Area," which summarizes some of the information about brucellosis as it might relate to management of bison and elk. This paper represents the factual information for which there is general agreement among the technical experts employed by the responsible state and federal agencies that are members of the GYIBC. The following summary of brucellosis, as it relates specifically to the management of bison that migrate from Yellowstone National Park into Montana, is based on that paper.

What is Brucellosis?

Brucellosis is a contagious bacterial disease caused by various species of the genus *Brucella* that infect domestic animals, wildlife, and humans worldwide. In North America, the primary livestock hosts of *Brucella* spp. are cattle (*B. abortus*), goats (*B. melitensis,* Mexico only), swine (*B. suis*), and sheep (*B. ovis*). The principal North American wildlife hosts for *Brucella* spp. are bison and elk (*B. abortus*), caribou and reindeer (*B. suis*), and feral and wild swine (*B. suis*). Brucellosis also may occur in carnivores, including dogs, and it is usually caused by *B. canis*. Wild canids also may develop antibodies to *B. abortus* without developing clinical infections or shedding the organism.

In cattle and possibly wild ungulates, transmission of *B. abortus* typically occurs through ingestion of the bacteria in birth materials shed from infected animals. The incubation period (the time between exposure and onset of infection) varies widely depending on exposure dose, previous vaccination, species, age, sex, stage of gestation, and susceptibility. Following a brief systemic (bodywide) infection, the organism typically localizes in the udder and/or lymphatic system and, depending on the stage of gestation, in reproductive tissues. Abortion is the characteristic sign of acute brucellosis. Other signs include retained placenta, infertility, reduced milk production, lameness, swollen joints, and swollen testicles. Microscopic lesions may also occur in lymph nodes. Following pregnancy, the *Brucella* organism may become dormant, persisting only within cells of the lymphatic system. Following a dormant period, acute infection may recur during subsequent pregnancy.

The organism is shed in aborted tissues, reproductive tissues, and discharges, especially just prior to, during, or soon after abortion or live birth. The organism also may be shed in milk for variable lengths of time. Some infected cattle, bison, and elk intermittently shed the organism. The quantity of *Brucella* organisms shed at any particular time is variable and the number of organisms that comprise an infectious dose also is variable.

There is no feasible treatment or cure for animals infected with *Brucella*. Some animals may develop immunity and never have the disease. Animals that overcome the clinical signs of brucellosis may develop recurrent infections

and thus may be a source of exposure and possible infection for other animals. Some animals may completely clear the bacterium. Some individual cattle are reported to have a natural resistance to brucellosis, and this trait may be inherited. Natural resistance may also occur in other species including bison.

Brucellosis Transmission

The primary mechanism for transmission of *B. abortus* in cattle is well understood. Typically, transmission occurs when susceptible animals come into direct contact with contaminated aborted fetuses, birth membranes, uterine fluids, or vaginal discharges from infectious animals. Ingestion of contaminated material is the primary route of infection. A female calf born to an infected dam (female parent) can also become infected in utero, but may not manifest the disease until it has matured and either aborted or calved. Infected females typically abort their first pregnancy following infection. Abortion usually occurs during the third trimester. Thereafter, the bacteria usually localizes in lymph nodes surrounding reproductive organs and the udder.

Transmission of *B. abortus* is less understood in wild ungulates. It is far less documented in elk than cattle, but it is believed to be similar to that described above. There is disagreement over the primary means of brucellosis transmission among bison. Research projects now underway are designed to provide more and better scientific information.

Brucellosis Diagnosis

Standard serologic tests for the presence of *Brucella* antibodies in milk and blood are used to identify potentially affected cattle herds. An affected herd is one in which one or more animals have been determined to be infected. The presence of antibodies is used as an indication of infection, particularly on a herd basis. Diagnosis is based on the results of serologic tests combined with other information, including individual animal and/or herd history, clinical signs, epidemiology, and bacteriology. The bacteriological procedures used to identify *Brucella* infection include culturing the bacteria from tissues, milk, udder secretions, aborted fetuses, and uterine discharges.

Some animals may lack antibodies but still may be infected, especially those incubating the bacteria. In contrast, antibodies may be present in an animal from which the bacteria have not been cultured. An animal with natural resistance to the *Brucella* organism that has been challenged with *B. abortus* will generally experience a short-lived antibody response. Tissues collected from these animals will be culture negative, supporting their resistance to infection. A herd is classified as an affected herd after *B. abortus* has been isolated from at least one animal in a suspect and/or reactor herd, or epidemiological data support that conclusion.

Killing suspect animals generally is necessary to obtain adequate samples for bacteriologic culture. Biopsy of tissues from live animals may also be performed. Biopsy is not currently a routine diagnostic technique, but is being evaluated as a research tool for studies of wild bison. Interpretation of culture results is difficult because the ability to isolate the bacteria varies with the location and abundance of *B. abortus* in the animal. The culture of *Brucella* organisms from tissue or blood is a definitive indication of infection; however, the organism may not always be recovered even though it is present. Failure to culture the bacteria may be due to inappropriate techniques, improper storage of specimens, or failure to use sufficient amounts of tissue.

It is not possible to determine or quantify the risk of bacterial transmission based on the results of these standard serologic and culture tests. Within a herd, the number of animals capable of transmitting the bacteria generally is less than the number of animals with positive blood tests. The number of infected animals generally is greater than the number of animals with positive culture tests. There is no test to specifically identify all infectious animals, i.e., those animals currently capable of transmitting brucellosis. It is assumed that if antibodies are present, the

animals must have had a large enough quantity of bacteria in their systems to trigger an immune response. Management actions in this environmental impact statement are based on the assumptions that (1) the antigen, i.e., *B. abortus*, must be present in the herd because the antibodies to *B. abortus* are present in this herd; (2) *B. abortus* is being transmitted from bison to bison because antibodies to *B. abortus* persist in this herd; and (3) therefore, there is a potential for brucellosis transmission from bison to cattle. In particular, it is assumed that each female bison testing positive for the presence of antibodies will shed the organism at some time in her life.

Brucellosis in Other Wild Ungulates

About 1.5% of the elk in the Montana portion of the GYA herd has consistently tested positive for *Brucella* antibodies. These include the Madison, Gallatin, Gravelly-Snowcrest, Absaroka, and Northern Yellowstone herds. These elk herds are free-ranging and do not use artificial feedgrounds. The seroprevalence of brucellosis in the southern elk herds, i.e , those associated with the National Elk Refuge and the feedgrounds managed by the state of Wyoming, is considerably higher (ranging from 3% to 65% seropositive) and probably maintained at high levels through increased exposure while on the feedgrounds. The source of brucellosis in GYA elk has not been identified. Six of the 104 elk (5.8%) harvested during the 1997 late hunt near Gardiner tested positive for brucellosis. At this time it is too early to determine what this rate of seropositivity in this one sample means. Were the agencies successful in eliminating brucellosis from the bison herd, elk could be a potential source for reinfection.

Bovine brucellosis only rarely occurs in deer, pronghorn, and mountain sheep, and any infection in these species is inconsequential to the management of brucellosis-affected bison and elk populations. Brucellosis has not been documented in any of these species within the Greater Yellowstone Area. One study suggested that when brucellosis occurs in moose, the disease appears to be systemic and typically causes death (Forbes et al. 1996). Whether moose are exposed is unknown.

Process for Bison Quarantine

A quarantine protocol has recently been developed for bison from Yellowstone and Grand Teton National Parks. According to the protocol, a bison quarantine facility can be used to test bison from either national park to qualify the animals as brucellosis-free. The facility must be approved by state and federal animal health officials. The complete protocol is included as appendix B.

Prior to entering the facility, bison must test negative on official brucellosis serological tests that are conducted at the National Veterinary Services Laboratories or at an approved cooperative state-federal brucellosis laboratory. Those bison found to be reactors (seropositive) must go either to slaughter or to an approved research facility. Bison not properly separated by fencing are considered one test group and will go through the quarantine testing protocol together. If any in the group are found to be reactors at any time, the rest of the group must start the testing protocol over. Thus, it would be advantageous to have a number of small test groups of bison rather than one or a few large test groups because fewer bison would have to start the testing protocol over if a reactor were found.

As a minimum, all bison must have three consecutive negative serological tests with at least 12 months between the first and last tests. In addition, specific age/sex groups have additional requirements. For example, all female bison not born in the facility must be bred and calve in the facility, and all bison in a test group having such female bison must be tested 30–90 days after calving and again six months after calving. Calves born in the facility may be released at six months of age provided certain conditions specified in the protocol are met.

Those bison that qualify as brucellosis-free could be moved intrastate or interstate provided the state animal health authorities in the receiving state authorize movement into their state. The new owners must agree to have the bison tested approximately six months and one year after release from the quarantine and must keep the bison separate from all other animals until the six-month test has been completed.

Risk of Transmission

There is considerable disagreement regarding the risk of *B. abortus* transmission from bison and elk to domestic livestock, the applicability of information derived from studies of the disease in domestic bison and cattle, and appropriate methods for the conduct of additional research to determine the risk of transmission. Prior to 1995 there had been no controlled field studies, specific to bison in Yellowstone National Park, to determine either the mechanism of *B. abortus* transmission from bison to livestock or the frequency of brucellosis-induced abortions. In 1995 a multiyear research project was initiated to study brucellosis transmission and the natural course of the disease in Yellowstone bison.

Most of the knowledge regarding brucellosis has been developed from studying the disease in cattle and captive bison, although a limited amount of published information has been developed from controlled and field studies of brucellosis in bison. Brucellosis may behave differently in cattle than in bison (see "Alternative Interpretation of Risk" below). It is also known that the infection behaves differently in chronically infected herds as compared to cattle or captive bison herds that experience a new outbreak of the disease. For instance, chronically infected bison and cattle have a lower frequency of brucellosis-induced abortions because they have a higher acquired immunity in response to frequent exposure to noninfectious doses. Chronically infected bison herds also have lower calving rates than uninfected herds.

It is not possible to quantify the risk of *B. abortus* transmission from bison and elk in the Greater Yellowstone Area to domestic livestock because most of the variables that define risk are unknown. However, it is possible to identify the various factors that affect risk and to qualitatively evaluate how alternative management approaches affect those factors. Important factors include the following:

1. Risk of transmission is affected by the degree of association between potentially infectious and susceptible animals. To become infected, a susceptible animal must come in contact with an infectious animal or discharges that contain a sufficient dose of viable *Brucella* organisms. Separation in space and time reduces the potential for transmission. In addition to separation that occurs as a result of management actions, separation may occur as a result of differences in behavior, habitat selection, geographic features, and distribution in response to weather.

2. The risk of *B. abortus* transmission increases as the number and density of infectious animals in the host population increases. Conversely, the risk is reduced when the number of infectious animals is lowered through reduction in animal crowding, reduction in population size, and vaccination.

3. The risk of transmission increases as the number of susceptible animals that may associate with infectious animals increases, and decreases as the number of animals that may be associated with infectious animals decreases.

4. The risk of transmission is affected by environmental factors. Outside its host, *Brucella* organisms have limited viability. Discharges remain infectious for longer periods during cold weather. Direct sunlight quickly kills the organism. Scavenging by wildlife reduces the occurrence of infectious tissues, but scavengers may also physically transport infectious tissues.

5. The risk of transmission is affected by the class of the infectious animals. The available evidence indicates that the primary risk of *B.*

abortus transmission from bison to cattle is contamination resulting from abortions and birthing events by infected adult female bison. However, limited available data documents the presence of *B. abortus* organisms in bison semen. Therefore, the risk of transmission from bull bison, although logically small, cannot be entirely eliminated based on existing information. Neutered animals are unlikely to transmit the disease.

6. The risk of transmission may be reduced by vaccination, neutering, and herd management (such as separation of animals in time and space).

7. Some animals are naturally resistant to infection.

Alternative Interpretation of Risk

As noted above, there is considerable disagreement about the significance of brucellosis in bison, especially the degree to which bison pose a risk of brucellosis transmission to livestock. There is no definitive information with which to resolve this disagreement. The following information summarizes ideas discussed during development but not included in the paper on "Brucellosis in the Greater Yellowstone Area" (GYIBC 1997).

The bulk of brucellosis research and disease management has focused on domestic livestock, yet limited published information suggests the disease may be transmitted differently and have different clinical, pathological, and population effects in bison (Williams, Cain, and Davis 1994; Meyer and Meagher 1995a).

Those who suggest that the risk is negligible point out that there have been no documented cases of brucellosis transmission from wild, free-ranging bison to cattle. No documented cases exist of wild, free-ranging male bison transmitting brucellosis to domestic cattle (bison and cattle may interbreed in captivity). Epidemiological studies, however, have indicated wildlife (probably elk) to cattle transmission of brucellosis on six Wyoming premises since the 1960s. In cattle, semen from an infected bull did transmit the disease when used in artificial insemination, but has rarely been observed as a result of natural breeding (Nicoletti and Gilsdorf 1994).

It is possible that, although brucellosis may be endemic in this bison herd, few of the animals are capable of transmitting the disease. This suggestion is supported by noting the discrepancy between the frequency of seropositive animals in samples collected at various times since 1917 and the frequency of culture positive animals in samples of tissues collected during 1991–92 to determine the presence of *B. abortus*.

Because of the technical difficulties in the isolation of *B. abortus* from bison tissues, the recovery rate is typically lower than the seroprevalence would suggest. Thus, as a negative culture does not provide conclusive evidence that the animals' tissues are free of bacteria, all seropositive animals are currently considered to be potentially infected. Studies are in progress to more specifically define the relationship between a seropositive animal and the isolation of bacteria from its tissues.

It has been theorized that the primary route of transmission among cattle (abortions and birthing events) may be different from that among bison. This suggestion is based on the infrequency of observed abortions in the Yellowstone area (usually required for transmission of the disease between cattle) and the discrepancy between the frequency of seropositive and culture positive animals. In bison, the disease may transmit through milk from cow to calf, which develops antibody response from repeated exposure (Meyer and Meagher 1995b).

BISON DISTRIBUTION

The Yellowstone bison population uses three different wintering areas in the park: Pelican Valley (the smallest), Mary Mountain (the largest, in the Hayden Valley-Firehole River

area), and the Lamar Valley or northern range (see Bison Winter Movements map). Individuals or small groups of bison (usually bulls) move to other areas of the park, or occasionally leave the park to the east, south, or southwest, but most movement from the park has been into Montana, along the Madison River to the west and the Yellowstone River to the north. Although at one time these groups were semidistinct subpopulations and continue to winter in these areas, the subpopulations are no longer distinct (Meagher et al. 1994).

Bison migrate from Yellowstone National Park during the winter into Montana in five general areas (also see Bison Winter Movements map). During some years, substantial numbers of bison move north across the Reese Creek boundary of Yellowstone National Park and onto adjacent private land along the Yellowstone River valley near Gardiner (the Gardiner Valley). These lands are leased to cattle operators who graze livestock year-round. Bison have historically used the Gardiner Valley, and would likely migrate much farther north without agency or other controls.

Bison drive - Upper Nez Perce Creek, 1966.

Large numbers of bison also move from Yellowstone National Park onto Gallatin National Forest in the Eagle Creek/Bear Creek area, northeast of Gardiner. Land use in this area emphasizes wildlife and precludes domestic livestock. Although most bison remain in this area all winter, some may move north and west beyond the Little Trail Creek/Maiden Basin hydrographic divide and onto private land in the Gardiner Valley.

Limited numbers of bison also migrate into the Hellroaring and Slough Creek drainages in the Absaroka-Beartooth Wilderness, a congressionally designated wilderness area to the east of the Eagle Creek/Bear Creek area. These drainages are geographically isolated from areas with permitted cattle. An occasional bison moves even farther east and leaves the park boundary by way of Cooke City or Silver Gate.

A few individual bison and small groups use public lands contiguous with the northwestern boundary of Yellowstone National Park in the area that is generally north of Grayling Creek/Fir Ridge and referred to as the Lee Metcalf Wilderness and Cabin Creek Recreation and Wildlife Management Area. Land use in this area emphasizes wildlife and precludes domestic livestock. Bison that use this area are unlikely to migrate farther but could associate with domestic livestock if they do.

During some winters, substantial numbers of bison move west along the Madison River, Duck Creek, and Cougar Creek and leave Yellowstone National Park in the vicinity of West Yellowstone, although they typically return to the park after snowmelt, normally around May 1. The numbers and timing are highly variable from year to year. After leaving the park, these bison either occupy public lands in the Gallatin National Forest that are allocated to multiple-use management or move onto adjacent private lands, some of which may be occupied by livestock during summer.

The number of bison migrating out of the park in any given year is impossible to predict. The policy of Yellowstone National Park has been to manage park resources with minimal human manipulation and to allow ecological processes, to the extent possible, to determine wildlife population levels. After termination of bison and elk reduction programs in the park in 1968, these wildlife populations have increased. As a result, some experts believe range resource conditions in the northern range of the park do not produce adequate forage for winter habitat resulting in increased bison migration. However, there is scientific evidence that shows that grassland

productivity is high, species diversity is stable, and the standing crop is not correlated with wildlife populations (Reardon 1996; Singer 1996; Wallace 1991, 1996; Frank-McNaughton 1996).

It has been further speculated that bison migration out of the park is facilitated by winter road grooming for oversnow machine use, or plowing for wheeled use during the winter (the highway from Mammoth to Cooke City is plowed for wheeled vehicle use during winter). Some bison use the roads for energy-efficient travel, particularly during winter. One line of argument is that energy-efficient travel provided by the roads allows bison to access habitats that would otherwise be too energy costly to use. This allows higher survival and facilitates movements to new areas. The memory of these access routes is retained and used in subsequent years.

The groomed road system in winter allows long distance movement over short periods of time that would otherwise not be possible, particularly in the park interior, where snow depths are typically much greater. On the northern range, where snow depths are significantly lower, it is not likely that bison use of groomed roads in this area provides them any meaningful energy savings.

The precise relationship between road grooming and bison movements is not well defined. Research to better understand these relationships has been initiated. As a result of the settlement agreement in "Fund for Animals v. Babbitt (D., D.C., Civ. No. 97-1126), Yellowstone National Park has recently (January 1998) decided to formally monitor wildlife movements and wildlife use of two segments of groomed roads (in Hayden Valley and along the Gibbon River) inside the park.

Stochastic events such as winter severity, snow depth, and access to forage and other periodic events are known to be important influences on bison migration. For instance, large migrations occurred in the severe winters of 1988–89 after large-scale fires burned much of the Greater Yellowstone Area and summer drought reduced forage for bison (and other wildlife), and in 1996–97 due to deep snow and ice.

Despite increases in migration during these events, the opportunities for transmission of brucellosis from bison to cattle have been negligible because bison management programs have not permitted bison to freely associate with domestic livestock during high risk periods (see "Administrative History of Bison Management" for more information on management actions).

ECONOMIC IMPACTS OF BRUCELLOSIS IN CATTLE

Agriculture has been and continues to be Montana's basic industry. It accounts for over 30% of the state's industrial sector employment, labor income, and gross sales. Approximately 64% of the state's 93 million acres is used for farming and ranching. In 1995, Montana agriculture generated $2 billion in cash receipts, of which cattle calves and dairy accounted for 40% of total cash receipts.

Left unchecked, the migration of brucellosis-infected bison from Yellowstone National Park into Montana could have not only direct effects on local livestock operators, but also on the cattle industry statewide. Production in infected herds could decline due to a number of consequences of the disease, including the following:

- *Abortions.* Abortion losses constitute the largest single cost of brucellosis in beef cattle. A cow that aborts or has a calf that does not survive because of the debilitating effects of brucellosis has, in effect, been maintained for a year without financial return.

- *Decreased weight gain by calves.* Calves from infected cows may have less than normal weight gains, since milk production from infected cows may be inadequate. Affected calves at the time of sale may weigh 100 pounds less than calves from healthy cows.

BISON WINTER MOVEMENTS
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • May 1998 • 101 • 20,107
to Livingston
Slip and Slide
Green Lake
Sentinal Butte
Mill Creek
Section 22
Park
Lion Creek
Yankee Jim Canyon
Maiden Basin
Eagle Creek/
Bear Creek Area
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
BEAVERHEAD NATIONAL FOREST
BUFFALO HORN CREEK
Wapiti
Gardiner
Stephens
Creek Area
REESE CREEK
YELLOWSTONE RIVER
HELLROARING CR.
BEAR CR.
DAVIS CR.
MONTANA
WYOMING
Cooke City
Silver Gate
to Red Lodge
SHOSHONE NATIONAL FOREST
SLOUGH CREEK
LEE METCALF WILDERNESS
LEE METCALF WILDERNESS
Mammoth
Hot Springs
Northern
Range
Herd
Tower-
Roosevelt
LAMAR RIVER
GALLATIN RIVER
YELLOWSTONE NATIONAL PARK
to Butte,
Sheridan,
and Dillon
Hebgen Dam
Cabin Creek Recreation
& Wildlife Mgmt. Area
MADISON RIVER
Watkins Creek
HEBGEN LAKE
Horse Butte
Horse Butte
Peninsula
DUCK CREEK
COUGAR CREEK
South Fork
Basin
Sulphur Springs
BEAVERHEAD NATIONAL FOREST
West Yellowstone
Norris
Canyon Village
Mary
Mountain
Herd
Hayden Valley
Madison
MADISON RIVER
GIBBON RIVER
Pelican
Valley
Herd
Fishing Bridge,
Lake Village,
and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
MONTANA
IDAHO
MONTANA
WYOMING
TARGHEE NATIONAL FOREST
YELLOWSTONE NATIONAL PARK
FOREST SERVICE GRAZING ALLOTMENTS
BISON WINTERING AREAS
(MEAGHER, UNPUBLISHED DATA)
HISTORIC BISON WINTER MOVEMENT
RECENT BISON WINTER MOVEMENT
HYDROGRAPHY
MILES
0
5
10
NORTH

- *Delays in calf production.* Brucellosis would result in some infected cows being difficult to breed, resulting in fewer market cattle each year.

- *Increased rates of culling and replacement.* Brucellosis-affected cows are usually culled at a faster than normal rate because of reproductive deficiencies. Another cost for affected herds would be the expenses related to additional testing and vaccinating. Testing for brucellosis is done every 30 days, as long as reactors are found. The herd is then retested after 90 days, and again after another 90 days (three negative tests in 180 days). After the quarantine is lifted, the herd is tested again after six months.

Current incomes from affected herds would be disrupted because of quarantines, and future incomes would be lost due to depopulations. Depopulation costs would be somewhat mitigated by the sale of affected cattle and indemnity payments, but in most instances indemnification would provide only partial compensation.

Producers statewide could suffer the marketing consequences of the disease. Sales at all levels — intrastate, interstate, and international — would be affected. There would be the direct impacts on sales of herd depopulations and quarantines, but far more detrimental to the state's livestock industry would be the requirement of a negative brucellosis test within 30 days before interstate movement. Of greatest consequence would be diminished interstate and international demand for test-eligible stock because of the presence of brucellosis.

Increased production and marketing costs and a contraction in demand would mean fewer breeding cattle sold out-of-state, and widespread losses for Montana's cattle producers. Nationally, stockgrowers and livestock disease management agencies have spent $3.5 billion to eradicate the disease from cattle (Frye and Hillman 1994). Any new outbreak would be a setback to this program.

Federal animal-disease regulations declare that the presence and spreading of brucellosis among cattle herds would place Montana's "brucellosis class-free status" in jeopardy. State animal health authorities may levy additional restrictions beyond those imposed by the Animal and Plant Health Inspection Service, which have the same impact as downgrading if they believe a threat exists from importing Montana cattle. In Montana increased testing could add $6 million per year statewide should an outbreak occur (State of Montana, L. Petersen, pers. comm. June 1997).

If brucellosis is diagnosed in a livestock herd, the affected herd is immediately quarantined. A thorough epidemiological investigation, including brucellosis testing, is immediately conducted to determine the origin and potential spread of the infection. An action plan is developed for potential source and destination herds. This action plan would likely include herd tests and may necessitate quarantine of additional herds.

If the affected herd is in a brucellosis class-free state such as Montana and is imported into the state, the herd must be either depopulated or returned to the state of origin to maintain class-free status. If the infection is found not to have been imported or has spread to other herds, class-free status is automatically suspended and the herd is kept under quarantine until it is brucellosis free or sent to slaughter. As a minimum, suspension of class-free status requires brucellosis testing of certain age/sex cattle prior to interstate shipment unless the cattle are going to slaughter or to a quarantine feedlot.

Since Montana producers export a majority of their commodity to other states and to international markets, the perception of diseased animals could impede producers from around Montana from marketing livestock. For instance, during the 1996–97 winter the state of Oregon imposed restrictions on the movement of untested livestock from Montana into Oregon. In 1994, APHIS informed the Montana State veterinarian that states surrounding Yellowstone

National Park would be downgraded from class-free status if the states failed to take action against bison within the state's borders when bison leave the park (letter to Dr. Clarence Siroky from APHIS dated December 9, 1994). Also in 1994 and 1995 the states of Idaho, Nebraska, North Dakota, Oregon, South Dakota, and Washington informed the Montana State veterinarian that testing requirements would be imposed on Montana cattle due to the emigration of bison into Montana from Yellowstone National Park. In 1994, 1995, and 1996 the Montana State veterinarian also received inquiries from other states regarding the presence of disease-exposed bison emigrating into Montana and whether testing requirements should be imposed.

The economic consequences of these actions would be felt by other segments of Montana's economy in communities throughout the state. While no specific information is available on the amount of livestock exported out of Montana, it is important to note every dollar of meat animal (beef cattle, sheep, hogs, and poultry) product sold to entities outside Montana results in approximately $1.25 of additional sales by Montana economic sectors tied to the meat sector (Bureau of Economic Analysis, U.S. Department of Commerce). Cash receipts from sales of cattle and calves in 1996 for Montana were $655,770,000 (Montana Agricultural Statistics Service, U.S. Department of Agriculture), and the average for the last five years is $730 million. Also, for every additional job in the meat animal sector, approximately 1.3 jobs are generated in the Montana economy.

The potential for such widespread economic consequences is a primary motivating factor in taking action to ensure brucellosis is not transmitted from Yellowstone bison to Montana cattle, and/or that federal downgrading or state sanctions do not occur. In this regard, all alternatives in this environmental impact statement include measures to "address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana" (see "Purpose of Action").

The agencies have taken action for several years to meet this goal, and are currently operating under an interim bison management plan (see following section on "Administrative History of Bison Management"). Compliance with the plan has had economic impacts on each of the agencies; these costs are reported in the description of alternative 1 (continuation of the strategies in the interim plan) in this environmental impact statement, as are estimated costs to implement alternatives 2 through 7.

Cattle drive, by Donnie Sexton. (NPS photo)

ADMINISTRATIVE HISTORY OF BISON MANAGEMENT

The need to cooperatively prepare a long-range bison management plan was formally recognized in July 1990, when the National Park Service, Montana Department of Fish, Wildlife and Parks, and U.S. Forest Service filed a "Notice of Intent" in the *Federal Register* to prepare an environmental impact statement examining options for such a plan.

The list of participating agencies was expanded to include the Montana Department of Livestock and U.S. Department of Agriculture, Animal and Plant Health Inspection Service. Both state agencies — Montana Department of Fish, Wildlife and Parks and Montana Department of Livestock — are represented as the state of Montana. All parties signed a May 1992 "Memorandum of Understanding" (see appendix C) to work together in developing a cohesive plan to meet their varying objectives.

During the development of the long-range plan and environmental impact statement, a series of four interim bison management plans and environmental assessments were prepared by the National Park Service (1990, 1992), state of Montana (1995), and National Park Service and state of Montana (1996). In general, these interim plans provided for agency personnel from Montana and the National Park Service to cooperatively shoot bison moving from Yellowstone National Park into Montana in order to achieve the objectives of protecting private property, providing for human safety, and maintaining Montana's brucellosis class-free status.

A finding of no significant impact and decision notice signed in August 1996 approved for implementation of the latest *Interim Bison Management Plan* (see alternative 1 in "The Alternatives" part of this environmental impact statement). Adjustments to the *Interim Bison Management Plan* were made by both state and federal agencies in 1997 (see appendix A). This bison management plan provided for capture of bison in Yellowstone National Park near the north boundary in the Stephens Creek area and shipment of bison to slaughter. Bison were allowed to enter the Eagle Creek/Bear Creek area northeast of Gardiner, Montana, as these public lands are wildlife winter range and no domestic cattle are present at any time. Capture of bison also took place outside Yellowstone in the West Yellowstone area, and seropositive bison and seronegative-pregnant females were shipped to slaughter. Seronegative-nonpregnant bison were released on public lands in the Horse Butte area.

After completion of the interim plan, work resumed on the long-term management plan and environmental impact statement. As part of a court-approved settlement agreement to a lawsuit Montana brought against the National Park Service and the Animal and Plant Health Inspection Service in 1995, the National Park Service, U.S. Forest Service, Animal and Plant Health and Inspection Service, and state of Montana agreed to complete the long-term bison management plan and environmental impact statement (this document) for public review according to a specific schedule.

OBJECTIVES IN TAKING ACTION

This section elaborates on the general and specific statements of purpose (objectives). The purpose statement agreed upon by the interagency team is as follows:

> To maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana.

The interagency team has defined a "wild, free-ranging population" of bison as one that is not routinely handled by humans and can move without restrictions within specific geographic areas. The operation of a capture facility would not affect the wild, free-ranging character of the herd. However, assigning bison to a quarantine facility would affect individual bison. These animals would be unlikely to return to Yellowstone National Park, but would be available to requesting organizations to establish or augment populations elsewhere.

The "economic interest and viability of the livestock industry in the state of Montana" is tied directly to the maintenance of a class-free designation by the Animal and Plant Health Inspection Service (see the above section on "Economic Impacts of Brucellosis in Cattle" and the "Socioeconomics" chapters in the "Affected Environment" and "Environmental Consequences"). The secretary of agriculture is authorized to make such regulations and take such measures as are deemed necessary to prevent the introduction or dissemination of any contagious, infectious, or communicable disease of livestock or poultry from a foreign country into the United States or interstate. The department has the authority to cooperate with states and political subdivisions in the control and eradication of diseases of livestock and poultry. The Cooperative State-Federal Brucellosis Eradication Program was implemented in partnership with the states to use the combined authorities to control and eradicate brucellosis. Under the program, individual states progress through various classifications by reducing the prevalence of brucellosis until brucellosis class-free status is attained.

To obtain class-free status under the requirements in Title 9, *Code of Federal Regulations*, Part 78 (9 CFR 78), a state must, among other things, conduct brucellosis ring tests on all dairy herds at least twice a year, test at least 95% of cows and bulls slaughtered annually, and successfully trace 90% of reactors back to the herds from which they originated. If field strain *Brucella* is found, an epidemiological investigation is conducted to identify possible sources of brucellosis. Appropriate action must be taken based on the results of this epidemiological investigation to eliminate the potential spread of brucellosis.

The Animal and Plant Health Inspection Service (APHIS) has agreed not to initiate a downgrade of Montana's brucellosis class-free status if Montana has complied with its responsibilities under the selected bison management plan. APHIS anticipates that any of the bison management plans (alternatives) outlined in this document would be sufficient to prevent the actual outbreak of disease in domestic livestock and the subsequent spread of brucellosis. Therefore, APHIS would not downgrade the brucellosis status of Montana based on the mere presence of bison migrating out of Yellowstone National Park into special management areas, or SMAs (management areas along the park boundary), in accordance with the selected bison plan (see "Actions Common to All Alternatives" in "The Alternatives" part of the document for the definition of an SMA).

The "risk of brucellosis transmission" to cattle and ranched bison is addressed through specific objectives, particularly numbers 5 and 6, identified below:

The nine objectives that the interagency team agreed would be used to help determine reasonableness of each alternative, and that would be applied to the selection of a preferred alternative are as follows:

1. *Address bison population size and distribution; have specific commitments relating to size of bison herd* – The policies of the National Park Service direct that native populations of wildlife be managed by natural processes in a relatively undisturbed setting to the maximum extent possible. Therefore, inside the park, bison population sizes would be determined by weather, winter snow depth, competition for forage, predation, and other environmental conditions. However, since uncontrolled movements of bison outside the park would be inconsistent with the purpose of the plan, each alternative also includes measures to control bison distribution. Each alternative also includes measures to prevent the population from dropping below low numbers as a result of increased kills by agencies controlling bison entries into the state. The agencies used mathematical models published in scientific literature to estimate the number of bison, based on plant forage production and winter severity, the park could support (Boyce and Gaillard 1992); see "Impacts on Bison Population" chapter of the "Environmental Consequences."

2. *Clearly define a boundary line beyond which bison will not be tolerated* – Each alternative defines a boundary on both the west and north where management actions take place. In some cases, the boundary is maintained through hazing or shooting; in others, capture facilities are also used.

3. *Address the risk to public safety and private property damage by bison* – The risk to public safety and private property damage by bison outside Yellowstone National Park is addressed as an environmental issue in the "Affected Environment" (part 3) and "Environmental Consequences" (part 4) of this document. With permission from the Department of Livestock, current state law allows private landowners to shoot bison occurring on private land and causing damage or considered a threat to safety.

4. *Commit to the eventual elimination of brucellosis in bison and other wildlife* – The interagency team concluded that the elimination of brucellosis, even in bison, is not within the scope of this management plan. This is because elk in the Greater Yellowstone Area also carry the disease, and it is potentially mutually transmissible between the two species. However, all agencies are committed to the eventual eradication of brucellosis from the Greater Yellowstone Area. This management plan is one of several steps in that process. The eventual elimination of brucellosis from the Greater Yellowstone Area is the task of a larger-scope plan, currently under discussion by the GYIBC. The interagency EIS team agreed actions in the bison management plan must not detract from this objective, and must demonstrate progress toward it.

5. *Protect livestock from the risk of brucellosis* – All alternatives include specific measures aimed at meeting this objective.

6. *Protect the state of Montana from risk of reduction in its brucellosis status* – The interagency team agreed this objective was referring to the federal status conferred by the Animal and Plant Health Inspection Service. Montana is currently identified as class-free. Producers are able to ship their cattle interstate to national and international markets with minimal program restrictions. Any change in this status could mean significant economic impacts for the livestock industry in Montana.

7. *At a minimum, maintain a viable population of wild bison in Yellowstone National Park, as defined in biological, genetic, and ecological terms* – Currently available information indicates that the bison population should be maintained above 580

animals in order to preserve minimum genetic integrity. This number in no way represents a management objective or goal for the herd, but is the lowest level to which the herd would be allowed to fall. Agencies would undertake actions beforehand to ensure that this number is not reached. This number is based on research from a private bison herd that determined the population size and structure needed to ensure random intermixing of breeding animals and avoid significant inbreeding (Knowles, unpub. data). The number may be adjusted as ongoing research provides new information.

8. *Be based on factual information, with the recognition that the scientific database is changing* – Professionals in the fields of wildlife science, livestock disease, wildlife disease, livestock management, and wildlife management do not agree on the central issues relating to brucellosis in Yellowstone bison. The disagreements include (1) the degree of risk of transmission from the bison to livestock, (2) the level of prevalence of brucellosis in the bison, (3) the safety and effectiveness of existing brucellosis vaccines, and (4) which management actions to take with regard to the disease in the bison. The agencies have agreed to support research to help resolve these issues and will update the bison management plan as new information becomes available. A list of research topics approved by the Greater Yellowstone Interagency Brucellosis Committee is found in appendix D.

9. *Recognize the need for coordination in the management of natural and cultural resource values that are the responsibility of the signatory agencies* – The agencies have interpreted this objective as a requirement for the cooperative compliance with statutes designed to protect cultural and natural resources that may be affected by bison management actions proposed in the plan. Impacts are most likely to come from actions called for in various alternatives, effects on bison populations, and effects from actions proposed such as construction and operation of capture or quarantine facilities or acquisition of additional range. Future site-specific NEPA analysis (including public review) may be required.

In addition to the objectives, the agencies have also recognized, as noted in the "Need for Action" section, that Yellowstone National Park is not a self-contained ecosystem for bison. Lower elevation range could provide areas for bison to winter adjacent to the park as well as additional management options. Three of the alternatives (2, 3, and 7) analyzed in this environmental impact statement include provisions for such possible acquisitions. Although the agencies agree any acquisition of grazing rights, easements, or property from willing sellers could be by a public entity, Yellowstone National Park has no plans for expansion of the park boundary.

CONSTRAINTS IN TAKING ACTION

Each agency involved in producing this environmental impact statement has well-established mandates. If these mandates conflict, the number of options for management may be affected. Discussions among team members have resulted in some alternatives being dropped from the analysis because they conflicted with agency mandates. None of the alternatives retained for analysis was outside the agencies' legal constraints.

Agency Responsibilities

The National Park Service manages bison inside park boundaries. Outside the park, in Montana, wildlife-management and wildlife-damage cases are supervised by the Montana Department of Fish, Wildlife and Parks. This authority extends onto Gallatin National Forest in the state of Montana. The U.S. Forest Service has the authority to manage wildlife habitat on the national forest, but the management of the wildlife itself is largely the responsibility of the Montana Department of Fish, Wildlife and Parks.

Because of the presence of brucellosis in Yellowstone bison and the risk of its transmission to domestic cattle, the Montana Department of Livestock and the Animal and Plant Health Inspection Service have a role in bison management. The Animal Health Division of the Montana Department of Livestock adopts rules, policies, and orders fostering the prevention, control, and extirpation of animal diseases.

Legal and Policy Mandates

A brief summary of the respective legal and policy backgrounds of each of these federal and state agencies is provided below (also see appendix E for legal and policy guidance). Each agency must satisfy its particular mandates and operate within its legislative and regulatory constraints. The alternatives analyzed in this environmental impact statement are considered implementable by each of the agencies involved, i.e., they meet these criteria.

The National Environmental Policy Act of 1969 requires consideration of the environmental effects of proposed federal actions. NEPA procedures ensure that environmental information is available to public officials and members of the public before decisions are made and actions are taken. This act has equal effect on all federal agencies involved in the management of Yellowstone bison. A similar state act, the Montana Environmental Policy Act (MEPA), applies to Montana state agency actions.

Yellowstone National Park, National Park Service, U.S. Department of the Interior. An act of Congress on March 1, 1872, established Yellowstone National Park as "a public park or pleasuring ground for the benefit and enjoyment of the people." The act required the secretary of the interior to "make and publish such rules and regulations" that will "provide for the preservation, from injury or spoilation, of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition." It also required the secretary of the interior to "provide against the wanton destruction of the fish and game found within said Park, and against their capture or destruction for the purposes of merchandise or profit." Fishing and hunting, for sport or personal subsistence, were informally considered appropriate uses of the park at that time.

On January 15, 1883, the secretary of the interior amended park regulations to "prohibit absolutely" public hunting of wildlife species, including bison, in the park, and to restrict fishing to sporting means. The precedent of allowing sportfishing and prohibiting sport hunting was applied in most subsequently created national parks.

The act of May 7, 1894, known informally as the first "Lacey Act," prohibited the "killing, wounding, or capturing at any time of any bird or wild animal, except dangerous animals, when it is necessary to prevent them from destroying human life or inflicting an injury . . . within the limits of said park." This law, which was enacted in response to a bison poaching incident, provided park managers with improved power to punish offenders.

On August 16, 1916, Congress created the National Park Service, whose mission is "to conserve the scenery and the natural and historic objects and the wildlife in parks and to provide for the enjoyment of the same in such manner, and by such means as will leave them unimpaired for the enjoyment of future generations."

The act of January 24, 1923, recognized the authority of the secretary of the interior to "sell or otherwise dispose of the surplus buffalo of the Yellowstone National Park herd."

Several recent planning and policy documents, including the *Yellowstone National Park Master Plan* (NPS 1974), the *Yellowstone National Park Statement for Management* (NPS 1991), and the *National Park Service Management Policies* (NPS 1988), require the protection of ecological processes and native species in a relatively undisturbed setting, and require that park planning be accomplished in a regional

context. This latter concern is summarized in the *Management Policies* as follows: "Recognizing that parks are integral parts of larger regional environments, the National Park Service will work cooperatively with others to anticipate, avoid, and resolve potential conflicts, to protect park resources, and to address mutual interests in the quality of life for community residents, considering economic development as well as resource and environmental protection."

Gallatin National Forest, U.S. Forest Service, Department of Agriculture. The national forests of the United States derive management authority and direction from a variety of laws. Principal among these are the following:

> The Creative Act of 1891, which authorized the president to set aside public lands as forest reserves.
>
> The Organic Administration Act of 1897, which specifies the purposes for which forest reserves might be established and provided for their protection and management.
>
> The Multiple Use-Sustained Yield Act of 1960, which established the multiple-use and sustained yield policies for management of the national forests.
>
> The 1974 Forest and Rangeland Renewable Resources Planning Act and the 1976 National Forest Management Act, which direct preparation of strategic plans for all Forest Service activities, including a comprehensive plan for each national forest.

Through these statutes the Gallatin National Forest maintains viable populations of existing native and desired nonnative vertebrate species, and maintains diversity of plant and animal communities to meet overall multiple-use objectives. These broad objectives are further clarified in the 1987 *Gallatin National Forest Land and Resource Management Plan*, which portrays a program of uses for these 1.8 million acres that best meets the demands of a diversified public. In addition to the general laws guiding Forest Service activities, an Act of May 26, 1926 (16 USC 37) is significant to management of the upper Yellowstone River corridor as it gives specific recognition and authority for federal acquisition and management of the northern winter range for migratory animals. This early recognition of need for extensive winter range, especially mentioning elk but not exclusive to them, continues to be expressed in land acquisition efforts by the Gallatin National Forest. In the last decade alone, some 12,000 acres of winter range has been added to the forest to complement acquisitions by the state of Montana, through partnerships with private organizations. Expressed in the preferred alternative (alternative 7) in this environmental impact statement is a tentative acquisition of some 8,000 acres of lands that may be acquired in title and another 2,000 acres of lands on which easements may be acquired for the benefit of wintering wildlife. For the portion of these lands that may become the Gallatin National Forest, priority for uses will be for big game winter range, as directed by the 1987 forest plan. The further utility of these lands for either concentrated uses or site-specific facilities will be determined through appropriate public involvement and NEPA decision-making processes.

State of Montana, Department of Fish, Wildlife and Parks. Montana statutes authorize the Fish, Wildlife and Parks Commission to set the policies for the protection, preservation, and propagation of the wildlife, fish, game, furbearers, waterfowl, nongame species, and endangered species of the state. Within the policies established by the commission, the Montana Department of Fish, Wildlife and Parks is responsible for supervising the management and public use of all the wildlife, fish, game, furbearing animals, and game and nongame birds of the state.

The 1985 Montana Legislature authorized a hunting season for bison. This legislation was repealed during the 1991 legislative session, making bison a game animal that cannot be legally hunted. This 1991 legislation and a House Joint Resolution adopted during the 1989

session are consistent expressions of Montana's concern for (1) the possible transmission of brucellosis from Yellowstone bison to domestic livestock, (2) the possibility of damage to private property when bison leave Yellowstone National Park, and (3) the implementation of a long-term, flexible management program in cooperation with Yellowstone National Park, Gallatin National Forest, the Montana Department of Livestock, and the Animal and Plant Health Inspection Service.

State of Montana, Department of Livestock. The Animal Health Division of the Montana Department of Livestock has statutory authority to protect and promote the Montana livestock industries through the adoption of rules, policies, and orders fostering the prevention, control, and extirpation of animal disease. The Department of Livestock has the power to quarantine, inspect, test, and slaughter animals in the interest of its mandated mission. The department may cooperate with the U.S. Department of Agriculture and other federal agencies to remove infection and suppress disease. The department may, in fact, adopt applicable portions of federal policies and rules to attain its goals. Some state statutes define specific prohibitions of certain actions that are counterproductive to sound disease suppression. These center primarily on requirements for entry of animals into Montana and for animals in known diseased herds or premises.

Between 1952 and 1985, eradication of brucellosis in cattle from Montana was a major control endeavor. Upon completion of the goal of eradication from cattle in 1985, the efforts against brucellosis have concentrated on preventing its reintroduction.

The Department of Livestock has specific statutes and rules pertaining to bison. The department has the authority to regulate estrayed or improperly disposed of animals that fit within Montana's legal definitions; this includes bison. Most legislative or regulatory authorities applied to diseased bison have evolved from experiences with privately owned bison classified as livestock. The Department of Livestock, however, makes no legal or medical distinction in addressing the disease risks presented by publicly owned bison versus privately owned bison. The department believes that this is appropriate when conflict areas lie within the jurisdictional boundaries of the state of Montana. Specific statutes (81-2-120 MCA) address the removal from the state of publicly owned bison originating from a herd infected with a dangerous disease when the disease may spread to persons or livestock or jeopardize the state's compliance with other state-administered or federally administered livestock disease control programs. In essence, wild bison may be summarily removed from within the state's boundaries by the safest and most expeditious means if they originate from a diseased herd. In Montana, Yellowstone National Park bison fit within these specific statutory obligations.

The Montana Department of Livestock, Animal Health Division, is funded by "State Special Revenue (per capita tax) sec. 15-24-901 through 931 (MCA), Article 12, sec. 1 sub (2) Montana Constitution." This tax is paid by all Montana livestock producers and no general fund monies are expended by the department.

Animal and Plant Health Inspection Service, U.S. Department of Agriculture (cooperating agency). The mission of this agency is to lead the national effort to protect, sustain, and improve the health, quality, and productivity of United States' agricultural resources. The Act of May 29, 1884, established the Bureau of Animal Industry and authorized the commissioner of agriculture to cooperate with states to prevent the spread of livestock diseases. The act also prohibited the transportation of diseased livestock from one state or territory to another.

Subsequent acts authorized the secretary of agriculture to establish regulations to prevent the introduction or spread of animal disease from a foreign country or from one state or territory into another, and to quarantine any state or portion of a state and prohibit transportation of animals to and from quarantine, and in other ways defined in detail the scope and effect of APHIS authority. Extensive authority was granted for cooperation with other agencies (state and

federal), not only in eradication and control of diseases, but also in research on those activities.

The act of July 2, 1962, prohibited the interstate movement of animals reacting to the tests for brucellosis, and subsequent regulations provided a system for classifying states or portions of states (areas), herds, and individual animals with respect to brucellosis status. States or portions of states are classified according to their rate of *Brucella* infection present in cattle and the general effectiveness of their brucellosis control and eradication program. The classifications are class free, class A, class B, and class C. States or areas that do not meet the minimum standards for class C are required to be placed under federal quarantine. Restrictions on the interstate movement of cattle and bison are generally more stringent for movements from class A states or areas than from class-free states or areas, and are more stringent for movements from class B states or areas than from class A states or areas, and so on. The most stringent restrictions are for movements from quarantined states or areas.

The National Park Service, U.S. Forest Service, and Montana Department of Fish, Wildlife and Parks initiated the process of preparing an environmental impact statement for an interagency bison management plan by publishing a "Notice of Intent" in the *Federal Register* in July 1990 (the Montana Department of Livestock and the U.S. Department of Agriculture's Animal and Plant Health Inspection Service joined the planning process shortly thereafter). In order to identify issues and alternatives to be considered, a public participation and interagency coordination program was developed. This effort, called "scoping," included the review of all relevant previous planning and management documents, as well as scientific and popular literature related to the issues involved.

In November 1989, prior to the publication of the notice of intent, a brochure entitled *The Yellowstone Bison: Managing a National Heritage* was published and distributed to provide an interested public with current information on the bison management issue. As a way of more completely informing the public on the issue's background, and of initiating public involvement, a booklet entitled *Yellowstone Bison: Background and Issues* was then published in May 1990. This booklet, distributed to the interested public, was accompanied by a scoping letter that suggested a range of alternatives for bison management.

Written and verbal public comments identifying issues and concerns about these suggested alternatives were sought from August 11 through October 31, 1990. Public scoping meetings were held in Gardiner, West Yellowstone, and Bozeman, Montana, on October 9, 10, and 11, 1990, respectively. Public responses to the scoping document were summarized and the comment summary was distributed to those interested in December 1990. A second public input session in spring 1991 focused on the review of a short list of alternatives.

During development of the long-range plan and environmental impact statement, a series of four interim bison management plans and environmental assessments have been prepared (NPS 1990, 1992; State of Montana 1995; NPS and State of Montana 1995). All have been publicly available or included public comment periods. The most recent of these was released to the public on December 20, 1995 (NPS and State of Montana 1995). This environmental assessment was on public review through February 2, 1996. The agencies received 260 comments from state and federal agencies, Native American tribes, organizations, and individuals. The agencies prepared a summary of public comments and issues, responses to issues, and corrections to the environmental assessment. A finding of no significant impact (FONSI) was signed on August 5, 1996, and made available to the public.

OBJECTIVES, ALTERNATIVES, AND ISSUES FROM PUBLIC COMMENTS

The scoping and public review processes described above provided the agencies with public input on objectives, alternatives, and environmental issues. Many of these suggestions became part of the analysis for this environmental impact statement and are enumerated below.

Objectives

The following objectives gathered through public commentary were incorporated by the interagency team in creating its list, discussed above (see "Objectives in Taking Action" section):

- Minimize impacts on bison population dynamics and behavior. (Objective #1, general purpose statement)

- Develop an ecosystem based, bison disease management plan. (Objective #1, general purpose statement)

- Control bison distribution (movements) and numbers. (Objectives #1 and #2)

- Protect human health and safety. (Objective #3)

- Maintain Montana's brucellosis-free status. (Objective # 6)

- Maintain a self-sustaining, genetically diverse bison population (a minimum viable population). (Objective #7)

- Determine impacts and cooperatively manage impacts on threatened and endangered species, wetlands, and historic and cultural resources. (Objective #9)

Alternatives Included in this Environmental Impact Statement

The following options suggested by the public were included in the range of alternatives analyzed in this environmental impact statement. Some were slightly modified, but are considered similar enough to the original suggestion to be included in this section.

Manage bison without lethal controls. Although alternatives minimize the use of lethal controls in some cases (alternative 2), none completely eliminates the option of shooting bison. This is because agencies could not meet the objective to "clearly define a boundary line beyond which the bison will not be tolerated" without the ability to use lethal means to control bison.

Provide opportunities for Native American tribes, other organizations, and the general public to obtain live bison. Concerns were expressed that live bison be made available to Native Americans, other organizations, or the general public as an alternative to the killing of bison by government agents or hunters. Many of these concerned citizens thought that Native Americans and other people would have the opportunity to benefit culturally, spiritually, and economically by receiving Yellowstone bison. Bison can be shipped live only after meeting the release requirements of an approved quarantine protocol. Alternatives 3, 4, and 7 include quarantine.

Some of these Native American groups have contacted various agencies expressing an interest in the participation of a quarantine facility program. One group, the InterTribal Bison Cooperative, consisting of 42 tribes in 17 states, has developed a proposal for a program for a quarantine facility. Another such group, One People, One Nation, is a nonprofit organization dedicated to returning the buffalo to native lands and is actively raising funds to assist the state of Montana in the cost of building and maintaining a quarantine facility. If the selected alternative includes quarantine, the location, funding, and design of the quarantine facility would be analyzed in a future NEPA process. The two proposals specifically mentioned, and others the agencies receive, will be among those considered and analyzed.

Provide opportunities for Native American Tribes, other organizations, and the general public to obtain bison carcasses. All alternatives include provisions to provide carcasses to social service organizations, tribes, or the general public or other organizations through auction.

Acquire additional lands for bison. Recent initiatives and public-private partnerships in acquiring elk winter range north and west of Yellowstone National Park were cited as effective ways to improve wildlife habitat availability north of the park. Alternatives 2, 3, and 7 in this environmental impact statement allow for acquiring additional winter range from willing sellers, or for altering cattle operations on those lands to remove susceptible cattle, or both.

Establish bison management areas outside Yellowstone National Park. A central question for the public and for land managers is which lands bison would be allowed to occupy. The alternatives provide a variety of answers to this question, including restricting bison distribution to Yellowstone National Park (alternative 5); allowing bison unrestricted access to most public lands they may seek to occupy (alternative 2); and allowing bison restricted access to designated public lands in and immediately adjacent to Yellowstone National Park (alternatives 1, 3, 4, 6, and 7).

Many concerns center, favorably or unfavorably, on the establishment of special management zones on public lands along the park boundary. The creation of special bison management areas (SMAs) adjacent to Yellowstone National Park is a part of all alternatives except alternative 5.

Restrict winter recreational use in Yellowstone National Park. Increasing winter recreational use of Yellowstone National Park, with concurrent winter grooming of roads for use by oversnow travel, is seen by some members of the public as contributing to increased bison population size and movement. Concern over these departures from traditional use patterns has resulted in an interest in reducing winter use in the park, presumably to restore more natural limitations on bison. Some changes in winter use activities are a part of alternative 2 and would also be a consequence of alternatives 5 and 6.

In a settlement agreement executed on September 23, 1997, in "The Fund for Animals v. Babbitt" (D. D.C., Civ. No. 97-1126), the National Park Service agreed to prepare a new winter use plan and environmental impact statement to evaluate a full range of alternatives on all aspects of winter use activities in Yellowstone National Park, Grand Teton National Park, and John D. Rockefeller, Jr., Memorial Parkway.

Modify cattle grazing allotments on the national forest to reduce conflict between bison and cattle. Concerns were expressed over existing grazing allotments, and if Gallatin National Forest should manage the allotments to emphasize use by livestock, wildlife, or a combination of both. All alternatives except alternative 5 allow for minor alterations in these allotments, including timing of use to accommodate both cattle and bison. Alternatives 2, 3, and 7 envision more changes to the allotments, including modifying operations to remove susceptible cattle or moving cattle operations.

Make Yellowstone National Park responsible for bison disease management. The bison that have occupied Yellowstone National Park continually since prehistoric times are the remnants of once larger herds that occupied much of the west. These bison have long been almost solely the management responsibility of the National Park Service, and some members of the public expressed a feeling that "this is the park's problem, so the park should solve it." Alternatives 5 and 6 address bison management primarily as a park operation with management operations almost entirely within the park boundary. However, in each of the alternatives analyzed in this environmental impact statement, Yellowstone National Park plans to be an active participant.

Conduct additional research and public education. The agencies agree that continued research and education into many aspects of bison and their management as well as brucellosis in bison and elk is needed. Efforts to collect and analyze research data and improve public education is an ongoing effort by all the agencies, and will in fact continue whether an interagency bison management plan is approved or not approved. The relevant research and its status are listed in appendix D. The agencies have developed this environmental impact statement based on the best currently available knowledge, and have included alternative interpretations when there is disagreement among the scientific community.

Alternatives Suggested but Not Analyzed

Members of the public also suggested a number of alternatives that were considered by the agencies, but precluded from further analysis. A brief discussion of each of these alternatives follows.

Fence the perimeter of Yellowstone National Park to physically prevent bison from migrating beyond the park boundary. Migrating bison are not easily deterred by normal fences. While substantial or electrified fences could limit bison migrations, they would have major impacts on the movements of other wildlife species, such as pronghorn, bighorn sheep, elk, moose, deer, and bear. Restricting these species has serious ecological and social consequences, including prevention of normal migrations of game species onto public lands (some of which are designated for winter use of animals moving from Yellowstone National Park) and concentration of animals in a confined area with resultant damaging effects on local vegetation. These consequences are inconsistent with both state and federal wildlife management policies. Fences also tend to create a zoo-like atmosphere that is contrary to the wildlife management policies of several agencies.

Adequate fences would also be expensive to purchase, install, and maintain, and their installation could cause major site impacts. Estimates for purchase and construction of "bison-proof" fences are $30,000 to $50,000 per mile depending on access and terrain. Yellowstone National Park has a perimeter of about 250 miles, and bison migrations from the park have at times occurred at a number of widely scattered points. Constant monitoring would be required to ensure that fences were not breached by animal damage, falling trees, or other events. Fences would be less effective, or perhaps even useless, during winter months, when snowdrifts could bury them and the bison could leave through the public access points of the park. For the above reasons, fencing the park is not being evaluated further, although limited, site-specific fencing will be retained as a management option.

Provide supplemental forage for bison to prevent them from migrating beyond the park boundary. As an expedient or temporary measure, the distribution of high-quality hay and commercially prepared rations at strategic locations near the park boundary could conceivably have the desired effect of encouraging bison to migrate no farther. However, hay baiting was largely unsuccessful even though it was used extensively in the 1970s to influence bison migrations. If done consistently, providing supplemental forage would do nothing to relieve the pressures of bison migrations. Over time, with such additional food sources, bison numbers might increase to unnaturally high numbers. Undesirable changes in behavior and social organization, and increased incidence of brucellosis infection and other diseases in bison would probably result from such long-term concentrations on artificial feeding sites. These outcomes are contrary to the intended purposes of a bison management plan and NPS policy.

Among professional managers and ecologists, supplemental feeding of wild herbivores is widely recognized as a poor range and wildlife management practice. Animals become increasingly dependent on the feedgrounds while they continue to forage heavily on vegetation in the vicinity, resulting in serious damage to native range.

Artificial feedsites are recognized as reservoirs of disease. Bison concentrated at such a feed site would be increasingly exposed to risk of infection by brucellosis, other diseases, and parasites. Other ungulates, especially elk, would be attracted to the feedgrounds, increasing their exposure to disease as well. The potential for subsequent transmission of brucellosis from these elk to domestic livestock also could increase.

For these reasons, supplemental feeding of bison to stop their migrations will not be evaluated further in this environmental impact statement.

Relocate bison to other public ranges or private lands. The option of relocating bison has been addressed in several of the alternatives

but with specific restrictions. The Animal and Plant Health Inspection Service's *Uniform Methods and Rules for Brucellosis Eradication* and relevant regulations control the relocation of brucellosis-exposed livestock. Once captive, these methods and rules would apply to bison. The unrestricted relocation of the captive bison would not be allowed and is therefore not analyzed further in the environmental impact statement. The relocation of bison successfully completing quarantine procedures is a part of alternatives 3, 4, and 7.

Stop oversnow vehicle (snowmobiles and other tracked vehicles) travel on all roads in Yellowstone National Park. A *Winter Use Plan for Yellowstone and Grand Teton National Parks and John D. Rockefeller Jr., Memorial Parkway* (approved in 1990) identified that use of snowmobiles and snowcoaches along road corridors, and maintenance of the road corridors (through grooming) for this use, were appropriate activities that would not result in significant impacts. Winter use of Yellowstone National Park is growing rapidly, and winter activities are undergoing monitoring and research. Yellowstone National Park, Grand Teton National Park, and the six surrounding national forests recently issued a joint assessment of winter use on federal lands within the greater Yellowstone ecosystem. Operationally, some oversnow travel is required for park maintenance and protection purposes during the winter months. Discontinuing maintenance (winter grooming) of some segments on some key roads within the park to reduce the number of bison migrating toward Montana boundaries is part of alternative 2. In resolving litigation challenging the winter use program in Yellowstone National Park, Grand Teton National Park, and John D. Rockefeller, Jr., Memorial Parkway, the National Park Service agreed to prepare a new winter use plan and environmental impact statement. The National Park Service agreed to consider a full range of alternatives for all winter use activities, and is scheduled to commence scoping on that document in 1998.

Control bison population numbers using current wildlife birth control methods. The purpose of actions proposed in this environmental impact statement is to maintain a wild, free-ranging bison population and maintain the brucellosis class-free status of Montana by ensuring a low potential risk of brucellosis transmission between bison and cattle. However, unlike this specific goal, contraception is broad-based and a nonspecific population control method.

Currently, the bison population numbers 2,156 animals (actual fall 1997 count). However, as population sizes increase to a point where numbers management is important, the ability to effectively use contraception falls. Research has been done on using contraception as a technique to limit the growth of certain nonnative wildlife populations elsewhere in North America. A six-year study of wild horses at Assateague Island National Seashore in Maryland showed promising results. However, researchers at Assateague indicated that a major factor in the success of that program was that they were dealing with a small population of animals (165 horses) confined to a relatively small island habitat (8,500 acres).

Bison population control using contraceptives would be a highly technical program, requiring professional personnel and specialized supplies and equipment. Some contraceptive agents must be delivered by hand, requiring handling of the animals. Others could be delivered remotely (by hypodermic darting, for example), up to a distance of 50 yards. In both cases, bison could develop conditioned avoidance, making it increasingly difficult to administer the agent.

Long-term effects of having a large number of nonreproducing animals in a herd are unknown. Hormonal contraception of females would suppress ovarian function, prevent estrous cycles, and reduce male attraction to females (McCullough et al. 1993). Immunocontraception does not prevent ovarian cycling, and males could be repeatedly attracted to females. The breeding season likely would be extended because of the polyestrous (multiple ovulation)

nature of nonpregnant animals and could have physiological effects on males and females. It is also unknown if immunocontraception would affect the immune system of bison and potentially make them more susceptible to disease.

For these reasons, contraception will not be considered as a population control strategy for bison in this environmental impact statement.

Using sterilization (neutering) as a means of controlling brucellosis in bison in Yellowstone National Park. The Animal and Plant Health Inspection Service's *Uniform Methods and Rules for Brucellosis Eradication* and relevant regulations offer sterilization as an option to livestock producers with brucellosis-exposed cattle. It has been suggested as a means of controlling the spread of brucellosis in bison as well.

Brucellosis is a disease usually affecting the reproductive tract of animals, causing abortions. It is transmitted primarily when noninfected animals come into physical contact with aborted materials or birthing products that harbor the *Brucella* organism. Sterilized female bison would be rendered harmless for any potential transmission of brucellosis given the biological circumstances for such transmission. The *Uniform Methods and Rules for Brucellosis Eradication* and relevant regulations require that bull bison also be sterilized, even though the risk of bulls transmitting the disease sexually is uncertain but unlikely.

Neutering, by whatever means and for whatever purpose, may alter the social interactions and behavior of bison, such as family bonds or the dominance of bulls during the rut. Sterilization, if done on a large scale, might have genetic influences on the population by eliminating preselected animals from the gene pool. And, neutering would not contribute to controlling migrations.

For these reasons, neutering bison and returning them to Yellowstone National Park will not be considered further in the environmental impact statement, although changing cattle operations to run steers or spayed heifers is a part of alternatives 2 and 3.

Depopulate the entire Yellowstone bison herd and replace it with brucellosis-free bison. The *Uniform Methods and Rules for Brucellosis Eradication* and relevant regulations provide owners of brucellosis-affected herds with the option of depopulation and herd replacement. Depopulation of the Yellowstone National Park bison herd is rejected for the following reasons:

1. While all Yellowstone bison have been exposed to brucellosis, not all are infected. Uninfected bison are no risk to cattle.

2. The removal of thousands of bison that have merely been exposed to brucellosis is unacceptable to most people who have submitted comments thus far.

3. Depopulation operations, by whatever method, would have negative impacts on other wildlife and park resources, including threatened and endangered species.

4. A portion of Yellowstone bison may have desirable genetic materials, such as a demonstrated immunity to brucellosis, to contribute to future genetics research and development, as well as to the biodiversity of the species and the planet. They are also descendants of the only continually wild bison herd in the United States.

5. Brucellosis is also found in elk in the Greater Yellowstone Area, so the risk of elk infecting a replacement bison herd renders depopulation meaningless.

For the reasons listed above, depopulation of the Yellowstone National Park bison herd will not be considered further in this environmental impact statement.

Allow native predatory animals to control the bison population. Yellowstone has an abundance of predators, including grizzly and black bears, mountain lions, coyotes, and

wolves, but to date these animals have had limited influence on the bison population. Coyotes, bears, wolves, and mountain lions may take an occasional bison calf, but there are other prey species, such as elk and deer, that are more numerous and more susceptible to predation than a healthy adult bison.

Wolves, which have been recently reintroduced on an experimental basis in Yellowstone National Park, may eventually reduce the bison population by some measurable amount. However, data from Wood Buffalo National Park in Canada indicates that wolf predation on bison is a major factor only in combination with major habitat changes or the lack of alternate prey (Carbyn, Oosenbrug, and Anions 1993). Because there are no indications that changes in the availability of alternate prey species or in major habitat are likely to take place in Yellowstone in the foreseeable future, wolves cannot be expected to have a major impact on bison populations.

While predatory animals will continue to play an important role in the natural systems of Yellowstone, they are not expected to significantly impact bison populations and will not be further evaluated in the environmental impact statement.

Control or eradication of brucellosis in elk. It does not appear possible to eradicate brucellosis from bison without also eradicating it from elk and is therefore not part of this bison management plan. However, eradication in both species will be addressed by the GYIBC in a future planning process.

Require livestock owners to stop raising cattle, to raise bison instead of cattle, or to graze only steers. Although incentives to eliminate susceptible cattle are parts of some of the alternatives analyzed, requiring livestock owners to modify their operations is not a legal option.

Require cattle to be vaccinated for brucellosis. The cooperating agencies have no authority to require vaccination of animals that remain on their owner's premises. Cattle producers are encouraged to voluntarily vaccinate cattle in high-risk areas. At this time, all Montana female calves near Yellowstone National Park are voluntarily vaccinated against brucellosis by owners (State of Montana, former state veterinarian, C. Siroky, pers. comm., May 21, 1997). State animal health authorities may also require vaccination of female calves grazed on public lands within a bison contact area (e.g., within the SMA).

Vaccination may adversely affect marketing of animals in some international markets, as several foreign countries perceive vaccination as a possible disease risk and know older vaccines can cause positive responses on diagnostic tests for brucellosis (see "Livestock Health and Operations" section).

Allow bison to exist without human influence. Allowing bison to exist without human influence would lead to their migration out of the park and eventually onto their historic range. This violates the interagency agreed upon purpose to "address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana," as well as objective #2 (clearly define a boundary line beyond which bison will not be tolerated), objective #4 (commit to the eventual elimination of brucellosis in bison and other wildlife), objective #5 (protect livestock from the risk of brucellosis), and objective #6 (protect the state of Montana from risk of reduction in its brucellosis status). For these reasons, the alternative to "do nothing" is considered unreasonable (see "Alternatives Considered but Rejected" section).

Restore bison to the Great Plains. Interest was expressed in allowing bison to recolonize large areas of the plains beyond the Greater Yellowstone Area, even "as far as St. Louis." For reasons stated above, this alternative is considered unreasonable and will be not analyzed further. However, all alternatives except alternative 5 do allow very limited numbers of bison to recolonize some public

lands beyond the boundary of Yellowstone National Park.

Environmental Issues

The public also asked that certain environmental issues be analyzed. Issues are environmental problems that might occur should action be taken as proposed. They are analyzed in this document in part 4, "Environmental Consequences." The National Environmental Policy Act requires that only important issues, e.g., those with the potential for significant or severe impacts, be discussed in an environmental impact statement, and that the discussion of unimportant issues be minimized or eliminated. Table 1 includes a summary of issues considered by technical experts on the interagency team to be important. Following the table is a brief discussion of issues considered, but eliminated as less important. The list of issues was created by both the public and agency specialists.

TABLE 1: ENVIRONMENTAL ISSUES AND CORRESPONDING IMPACT TOPICS

Description of Environmental or Other Issue	Corresponding Topics in Part 4, "Environmental Consequences," Where Impact is Discussed
Lethal means of control would reduce bison population numbers, but not below an established minimum (580 bison) required to maintain genetic viability.	Impacts on bison population chapter, methodologies for analyzing impacts section
Slaughter and shooting, used by agencies to maintain separation of cattle and bison and reduce the risk of transmission of brucellosis, would slow natural growth rates of the Yellowstone bison population.	Impacts on bison population chapter, effects on the bison population section
Parkwide slaughter of seropositive bison (in alternative 5) would temporarily drop population numbers below the lower end of the range of bison for which agencies would manage.	Impacts on bison population chapter, effects on the bison population section
Vaccinating calves (alternatives 1 through 7) would result in lower seroprevalence rates in the bison population.	Impacts on bison population chapter, seroprevalence in the bison population section (alternatives 1 through 7)
Parkwide vaccination of calves and adults would, in combination with capture and slaughter, reduce seroprevalence rates to near zero.	Impacts on bison population chapter, seroprevalence in the bison population section (alternatives 5 and 6)
Hunting would reduce population numbers in special management areas outside the park in alternatives 3, 4, and 7.	Impacts on bison population chapter, effects on free-ranging status and distribution of bison section (alternatives 3, 4, and 7)
Winters with varying severity or other periodic events would result in varying migrations of bison outside the park.	Impacts on bison population chapter, stochastic influence on bison population section
Increases in bison population numbers, which would occur in alternatives 1 through 4 if winters are normal, would increase viewing opportunities for Yellowstone area visitors.	Impacts on recreation chapter, bison viewing section (alternatives 1 through 4)
Decreases in bison population numbers, which would occur for up to 15 years in alternatives 5 through 7, would decrease viewing opportunities for Yellowstone area visitors.	Impacts on recreation chapter, bison viewing section (alternatives 5 through 7)

Description of Environmental or Other Issue	Corresponding Topics in Part 4, "Environmental Consequences," Where Impact is Discussed
Changes in winter road grooming, road plowing, or road closures on some roads inside Yellowstone National Park to keep bison from migrating outside the park boundaries would mean snowmobile and snowcoach traffic on these roads would be displaced.	Impacts on recreation chapter, winter recreation section (alternatives 2, 5, and 6)
Bison hunting, if approved by the Montana Legislature, would supply additional recreational opportunities in the Yellowstone area.	Impacts on recreation chapter, hunting section (alternatives 3, 4, and 7)
Perceived risks of brucellosis transmission to cattle in the Yellowstone area may cause producers to leave the area.	Impacts on livestock operations chapter, cumulative impacts common to all alternatives section
Yearly testing of herds in the parts of Montana adjacent to Yellowstone where bison may range in some alternatives would add to the cost of livestock operations.	Impacts on livestock operations chapter, brucellosis testing and vaccinating section
Changing operations to remove susceptible cattle may be difficult for livestock operators, as changes in equipment, structures, and personnel would be required.	Impacts on livestock operations chapter, conversion from cow-calf to steer or spayed heifer enterprise section (alternatives 2 and 3)
Modifications in public grazing allotments may displace cattle herds to other locations and increase demand for grazing resources.	Impacts on livestock operations chapter, Gallatin National Forest grazing allotments section (alternatives 2 and 3), and impacts on socioeconomics chapter, summary of benefits and costs section
Acquisition of easements or purchase of property from willing sellers as winter range for bison would cost taxpayers money.	Impacts on livestock operations chapter, private land acquisitions and easements section (alternatives 2, 3, and 7)
Bison may damage fences, livestock, and other private property if they leave the park.	Impacts on livestock operations chapter, property damage by bison section
Upon completion of the quarantine procedure, live bison may be used to seed herds on Native American reservations and improve income for tribes (alternatives 3, 4, and 7).	Impacts on socioeconomics chapter, minority and low-income populations section
Increases in tourism and individual entrepreneurs are offsetting the decline in resource extraction industries in the Yellowstone area to maintain a prosperous economy in Gallatin and Park Counties.	Impacts on socioeconomics chapter, cumulative impacts common to all alternatives section
Changes in winter road grooming, road plowing, or road closures on some roads would reduce winter tourism-related income in West Yellowstone and the Greater Yellowstone Area.	Impacts on socioeconomics chapter, regional economy section (alternatives 2, 5, and 6)
Bison hunters would benefit the economy of the Greater Yellowstone Area through dollars spent while in the area.	Impacts on socioeconomics chapter, regional economy section (alternatives 3, 4, and 7)
Reducing bison numbers through lethal means may trigger a boycott with economic consequences.	Impacts on socioeconomics chapter
Changes in cattle operations or acquisition of easements or property from willing sellers may change the contribution of livestock-related dollars to the regional or state economy.	Impacts on socioeconomics chapter, regional economy section

Description of Environmental or Other Issue	Corresponding Topics in Part 4, "Environmental Consequences," Where Impact is Discussed
Bison that are shot or slaughtered may be released to Native American tribes, and to charitable organizations.	Impacts on socioeconomics chapter, minority and low-income populations section
Bison are perceived many different ways, and their slaughter and shooting offends some.	Impacts on socioeconomics chapter, social values section
If bison are perceived as disease-carrying animals, ranchers outside the park boundaries may be worried their lifestyle will be threatened.	Impacts on socioeconomics chapter, social values section (alternatives 2, 3, and 7)
People are willing to pay additional taxes to secure land for bison if it would reduce or eliminate slaughter and return more natural conditions.	Impacts on socioeconomics chapter, nonmarket values section
Increases in the bison population would mean increases in tourism; decreases would mean decreases in tourism.	Impacts on socioeconomics chapter, nonmarket values section
Food sources for grizzly bear, including whitebark pine nuts and cutthroat trout, are decreasing in the Greater Yellowstone Area due to blister rust and the accidental introduction of lake trout to Yellowstone Lake, respectively. This, in combination with increased private development, increased recreation, and timber harvest has influenced the amount and quality of grizzly bear habitat.	Impacts on threatened, endangered, and sensitive species chapter, cumulative impacts common to all alternatives section
Grizzly bears and gray wolves may lose habitat from the construction of capture or quarantine facilities.	Impacts on threatened, endangered, and sensitive species chapter, impacts common to all alternatives section
Shooting, hazing and other human activities may displace or disturb grizzly bears and gray wolves in the short term.	Impacts on threatened, endangered, and sensitive species chapter
Bison serve as live prey and carrion for grizzly bears and gray wolves. If more bison are present, these predators may fare better; if bison numbers are decreased, some grizzly bears, wolves, and other species may suffer.	Impacts on threatened, endangered, and sensitive species chapter
Grizzly bears feed primarily on bison and elk carrion when they emerge from their dens in the spring in the park interior. However, increased bison populations provide more carrion and more bears enter the summer in good condition.	Impacts on threatened, endangered, and sensitive species chapter (alternative 2)
Grizzly bears feed primarily on bison and elk carrion when they emerge from their dens in the spring in the park interior. If bison are slaughtered in large numbers, bears may be adversely affected.	Impacts on threatened, endangered, and sensitive species chapter (alternative 5)
A decrease in snowmobile use in the park, with a result in increased use on the adjacent national forests, may shift the location of effects on various sensitive wildlife species, including the wolverine and lynx.	Impacts on threatened, endangered, and sensitive species chapter (alternatives 2, 5, and 6)
A capture facility at Seven-Mile Bridge may disrupt nesting trumpeter swans as well as displace wintering swans.	Impacts on other wildlife species chapter (alternative 6)
Large numbers of bison may displace ungulates like elk, deer and bighorn sheep where they overlap.	Impacts on other wildlife species chapter, impacts common to all alternatives section
If bison populations increase, predators and scavengers will benefit. If they decrease, predators and scavengers may suffer.	Impacts on other wildlife species chapter, impacts common to all alternatives section

Description of Environmental or Other Issue	Corresponding Topics in Part 4, "Environmental Consequences," Where Impact is Discussed
Capture operations, hazing, and shooting may affect wildlife through displacement and disturbance.	Impacts on other wildlife species chapter
The Stephens Creek facility is located on pronghorn winter range. It removes habitat and displaces animals from the area.	Impacts on other wildlife species chapter.
Wing fences and corrals in capture facilities may inadvertently capture other ungulates.	Impacts on other wildlife species chapter.
Acquisition of additional wildlife winter range in the Yellowstone River valley near Gardiner would provide additional habitat for elk, mule deer, bighorn sheep and pronghorn.	Impacts on other wildlife species chapter
People who work in slaughterhouse, hunters, and veterinarians or laboratory personnel working with infected carcasses or tissues are at risk of exposure from brucellosis if proper procedures are not followed.	Impacts on human health chapter
Shooting, blood, and viscera associated with killing bison is not visually appealing.	Impacts on visual resources chapter

ISSUES CONSIDERED BUT NOT EVALUATED FURTHER IN THE ENVIRONMENTAL IMPACT STATEMENT

If an issue was considered to either be outside the scope of the environmental impact statement, or the best available scientific evidence indicated it would experience only negligible impacts, it was eliminated from further analysis, as per NEPA requirements. The issues considered but not evaluated further in this document are as follows.

State vs. federal authority to manage bison. To some, the bison management issue is perceived as a local situation not requiring the involvement of "outsiders." In this view, which often translates into a state versus federal authority issue, local regulatory and management agencies should take care of their own decisions. This position is not considered further because, as outlined above under "Legal and Policy Mandates," state and federal laws dictate management authorities for each of the cooperating agencies. None of the cooperating agencies has the option to ignore its responsibilities or abrogate its authority to another agency for wildlife or disease management. Furthermore, the agencies have made a conscious effort and signed a "Memorandum of Understanding" (see appendix C) to work together to develop this bison management plan.

Agencies are being influenced by the livestock lobby and protecting the livestock industry. Concern has been expressed that the livestock industry has a disproportionate influence over the planning process. It is probably the belief of those on any side of an issue that those on the opposite side have more power and influence. This issue is beyond the scope of the environmental impact statement, and not relevant as the agencies have made every effort to address all concerns without giving any one individual or group opinion any more weight than any others. This issue will not be further evaluated in the environmental impact statement.

Livestock grazing impacts on public lands. A variety of livestock-related concerns involved the impacts of livestock on public lands administered by the U.S. Forest Service. Concerns expressed included the beliefs that the livestock industry had excessive political power, that livestock should not be grazed on public lands but wildlife should, that livestock are damaging public land ranges, and that bison should be

given preference over livestock on grazing lands adjacent to Yellowstone National Park. Livestock grazing is a legally authorized activity on many public lands, and these issues are beyond the scope of this environmental impact statement, although modifications in public allotments on the Gallatin National Forest are part of alternatives 2 and 3.

Bison should be listed as a threatened or endangered species. The agencies do not believe that bison as a species meet the criteria for listing under the Endangered Species Act.

Vegetation and vegetative communities. The bison diet consists of sedges and grasses, and these plant communities may experience small changes if population numbers in any one area were to increase or decrease dramatically for a long period of time, e.g., if bison density were to change.

Bison would also exert a more intense impact on vegetation in capture facilities and quarantine areas through trampling. Building facilities and associated structures would also result in the removal of some vegetation as land is cleared for construction. Surveys would be conducted before these facilities are built to ensure no threatened, endangered, or sensitive plant species are present. Otherwise, impacts on vegetative communities to build capture and quarantine facilities proposed in the alternatives are negligible compared to total similar vegetation in the study area.

On the Gallatin National Forest, standards for range condition will be met in accordance with the *Gallatin National Forest Plan* (p. G-14). This issue will not be evaluated further.

Overpopulation of humans. Concern exists that wildlife and wildland are primarily threatened by "encroaching civilization" and increasingly intensive use of landscapes by humans. This issue is beyond the scope of the environmental impact statement and will not be analyzed further.

Impacts on bison genetics. Based on data available at present, a minimum of 580 or more bison (Knowles, unpub. data) is required to maintain genetic viability and diversity in the population. None of the alternatives is expected to reduce the bison population to 580 animals. In fact, in the long term all alternatives would maintain populations at or above 1,700.

Brucellosis in elk and other wildlife species. One concern involving brucellosis is that it is also present in the Greater Yellowstone Area elk, which raises questions of the value of attempting to eradicate brucellosis from bison when elk will still carry it and may transmit it back to bison. This issue involves, to one extent or another, most or all of the elk herds in the GYA, and involves lands in Montana, Wyoming, and Idaho. This issue is beyond the scope of this environmental impact statement, but will be addressed by the GYIBC in a future planning process.

Bison and elk at Old Faithful, by D. L. Cole, 1962. (NPS photo)

Brucellosis survival value in ungulates. Concern exists that brucellosis may have evolutionary survival value in wild animals that have it and seem to have built up a resistance to it; apparently the implication is that loss of the disease in a given ungulate population could lead to that population's increased vulnerability in the future. Brucellosis was not identified in Yellowstone bison until the 20th century, meaning that the bison presumably survived a variety of environmental conditions for several thousand years without such resistance, just as they survived the disease when it was trans-

mitted to them, probably from domestic livestock. This issue is beyond the scope of the environmental impact statement and will not be analyzed further.

Impact of capture facilities on special natural or cultural resources. Capture facilities would be located using specific criteria outlined in part 2, "The Alternatives." These criteria include minimizing impacts on wetlands, threatened and endangered animals and plants, and important historic or other cultural resources. The exact location of capture facilities is unknown in alternatives 5 and 6. If agency decision makers choose either of these alternatives, the facilities would be located within the general areas described in "The Alternatives" using the above criteria. Additional site-specific compliance, including impact analysis, may be necessary to construct and operate additional capture facilities.

Impact of quarantine facility on special natural or cultural resources. If a quarantine facility is located on public land, or built using federal or state money, it would be located using at least the same specific criteria as outlined for capture facilities. These criteria include minimizing impact on wetlands, threatened or endangered animals and plants, and important historic or other cultural resources. Additional impact analysis and site-specific compliance with environmental laws would be required to build such a facility on public land. Therefore, although these resources and impacts on them are discussed generally in this environmental impact statement, the specifics are not known and cannot be evaluated in detail.

Impacts on air quality. Air emissions from trucks transporting bison to slaughter would occur if alternatives 1, 3, 4, 5, 6, or 7 were selected. In addition, particulates and other pollutants from diesel generators required at any of the capture facilities in alternatives 5 and 6 would have a temporary adverse impact on air quality. Because impacts are expected to be negligible, they will not be analyzed further in this environmental impact statement but would be analyzed in any siting evaluation.

Impacts from noise. Generators, snowmobiles, and management activities may result in temporary, minor disturbances to workers or wildlife. The impact of these disturbances to wildlife is addressed in the "Environmental Consequences" part of this document. The impact to humans is negligible and is not analyzed further in this environmental impact statement.

THE ALTERNATIVES

As indicated in "Purpose of and Need for Action," the agencies developed a statement of need, a statement of purpose, and nine specific objectives they believed each alternative had to meet to a large degree before it could be considered reasonable. If the alternative met these objectives, fulfilled the purpose of taking action, complied with legal or regulatory mandates of each agency, and was technically and economically feasible, it was included in the range of alternatives analyzed in this environmental impact statement. Notably, agency mandates differ, and this difference is reflected in the divergent nature of the purpose statement and objectives, as well as in the range of alternatives analyzed.

The objectives and alternatives were developed through a six-year ongoing planning effort (see "Administrative History of Bison Management" section of the "Background") that included several opportunities for public input. Alternatives were added in response to this input. Several commenters insisted on management without lethal controls. Although this type of bison management was considered and rejected from further analysis, the agencies developed alternative 2 as the means to minimize lethal controls and accomplish the purpose of and need for this environmental impact statement. Alternative 3 is similar to a proposal, referred to as the "citizens' alternative," that was developed by representatives from a broad range of conservation, hunting, livestock, and tribal interests. Alternatives 5 and 6 are two different approaches to substantially reduce the incidence of brucellosis in the Yellowstone bison herd, a consistent concern of the livestock industry.

Agency decision makers met in March 1997 to review a list of objectives they had developed in 1992 (see "Objectives and Constraints" in the "Purpose of and Need for Action"). Originally, this list would have driven the selection of only the preferred alternative. However, decision makers agreed that all alternatives must meet these objectives, resolve need, and fulfill the purpose of action to some degree to be carried forward for analysis. This approach would provide agencies several practical options, all of which are implementable. The decision makers also agreed that the existing six alternatives (alternatives 1 through 6 in this environmental impact statement) the agencies had developed with help from public input represented the full range of options. Like agency mandates, public opinion on how bison should be managed proved to be diverse.

In June 1997 agency decision makers met to review information from the in-house draft environmental impact statement and select a preferred alternative from among the six alternatives. However, the agencies found that none of the six alternatives adequately met all their respective needs, and a seventh alternative was developed. Alternative 7 has features of other alternatives, but is also distinct.

In response to public input and agency needs, the range of alternatives was created to "capture" the most divergent, yet reasonable, scenarios each agency could legally implement. Where one might emphasize the "wild, free-ranging population of bison" piece of the purpose statement, another might focus on "addressing the risk of brucellosis transmission." Some also emphasized different management techniques, such as hunting, quarantine, or vaccination. Alternatives were also built to illustrate the effect of the presence or absence of a particular technique. For instance, the impact of quarantine is best understood by comparing alternatives 1 and 4, as they are similar except for quarantine. The effect of vaccinating the entire herd for several years is illustrated by comparing alternatives 5 and 6, which are nearly identical except for this feature. The impact of acquiring land to the north of the park is most clearly understood by comparing alternatives 4 and 7. The "theme" of each alternative is described below to show some of these differences.

Alternative 1 is the no-action alternative. As defined by the National Environmental Policy Act, the no-action alternative in this case is a continuation of the 1996 *Interim Bison Management Plan*. The 1996 plan was modified by state and federal agencies to maintain a generally stable bison population during the winter of 1997–98. The no-action alternative does not consider those modifications; however, the modified features of the interim plan are analyzed under other alternatives. For example, all alternatives except alternative 5 provide for the tolerance for bison posing a lower risk of transmission on public lands at lower population numbers; Alternatives 3, 4, and 7 contemplate holding seronegative bison and feeding them at the Reese Creek facility at the lower end of the population range; Alternative 7 also considers the effects of moving the Madison River capture facility to Horse Butte. Appendix A includes state and federal documents on adjustments to the *Interim Bison Management Plan*.

Alternative 2 focuses on changes in cattle operations outside the park and minimal, nonlethal methods of management to ensure separation and minimize the risk of disease transmission between bison and cattle. It assumes acquisition through purchase, easement, or other means of the largest tracts of land from willing sellers on property adjacent to the park for bison winter range. Alternative 5 is at the other end of the spectrum. It assumes bison would not be allowed to leave Yellowstone National Park and maximizes agency management of the herd. The focus of this alternative is the elimination of brucellosis from bison through the capture of all bison in the herd and the slaughter of all seropositives.

The other alternatives are more moderate in the amount of land available to bison and the intensity and use of management techniques than alternatives 2 or 5. Alternative 3 relies on hunting of bison to regulate population numbers and distribution of bison outside the park, and separation in time and space to preclude contact of bison with cattle. Where hunting is infeasible, capture and shipment of seropositive bison to slaughter and seronegative bison to quarantine are used. Alternative 3 includes provisions for acquisition of some winter range to the north of the park's Reese Creek boundary.

Alternative 4 is similar to the *Interim Bison Management Plan*, but it includes quarantine and hunting as additional bison management tools. Although bison leaving the park to the west are allowed to occupy public lands, private land abuts the park to the north. Under the interim plan, all bison leaving the park to the north are shipped to slaughter, regardless of whether they test seropositive or seronegative. A quarantine facility would allow agencies to ship seronegative bison live to complete a protocol, whereupon they would be available to tribal governments or others. A quarantine facility and hunting would also give agencies management tools they do not now have under the interim plan to manage the population size to some degree.

Alternative 6 is a variation of alternative 5, as it, too, focuses on the elimination of brucellosis from the bison herd. However, parkwide capture, test, and slaughter would not begin until a safe and effective vaccine had been applied to the entire herd for a number of years. Bison would be tested, and when seroprevalence had leveled off, capture, and slaughter of remaining seropositives would begin.

Alternative 7, the preferred alternative, departs from all other alternatives in that a range of bison population numbers would be the focus, and specific management scenarios would be put in place as the population approaches either end of that range. As the bison population approaches 2,500, the upper end of the range, the agencies would increasingly use lethal means to enforce separation of cattle and bison and to maintain population limits. At the lower end, 1,700 bison, agencies would cease all but the most necessary lethal means to maintain separation. Beyond this, alternative 7 includes a mix of management techniques similar to alternatives 1, 3, 4, and 6. Capture and slaughter of seropositives is the primary means of managing risk, as it is in alternatives 1, 4, and 5. Low levels of hunting outside the park are also

allowed, as they are in alternatives 3 and 4. Land to the north of the park's Reese Creek boundary may be acquired, as is proposed in alternative 3. Parkwide vaccination with a safe and effective vaccine is a part of all alternatives, including the preferred alternative.

The agencies believe that these seven alternatives represent a full range of options for management techniques and habitat available to bison to ensure separation between cattle and bison, minimize the risk of transmission of brucellosis to Montana cattle, and maintain a wild, free-ranging bison population. All seven alternatives address the stated agency need for taking action and fulfilling the stated purpose of taking action. Although the alternatives may differ in the degree to which they meet one or more of the objectives (see "Objectives and Constraints" section of the "Purpose of and Need for Action"), the agencies have agreed that each alternative meets all nine objectives to a large enough degree to be considered reasonable. All alternatives are analyzed in similar detail in the "Environmental Consequences" part of this environmental impact statement.

Bison at Old Faithful, 1970.

INTERAGENCY INVOLVEMENT

Cooperation among agencies is essential to maintain a wild, free-ranging bison herd in Yellowstone National Park and to maintain Montana's federal brucellosis class-free status. The bison traditionally spend summers in Yellowstone National Park, which is managed by the National Park Service, and some move in winter outside the park to neighboring USFS and private land. In Montana, wildlife is managed by the state's Department of Fish, Wildlife and Parks, and cattle diseases are managed by the state's Department of Livestock. Both of these agencies are referred to as the state of Montana in this document. The Animal and Plant Health Inspection Service determines whether Montana is class-free, i.e., its cattle can be moved interstate without brucellosis testing. Animal health authorities in each individual state may impose import regulations equal to or more restrictive than APHIS regulations as long as there are no irreconcilable conflicts with APHIS regulations. Within the identified management boundary for each alternative, different agencies would have primary authority for various management activities. However, agencies would share responsibility for bison management actions.

These agencies have agreed through a "Memorandum of Understanding" (see appendix C) to devise a long-range management plan that is mutually acceptable. Each alternative evaluated in the range of alternatives in this environmental impact statement is one that the agencies considered technically and legally implementable. The alternatives also represent the further limits of acceptability on each side of the range. Those alternatives considered infeasible or illegal have been eliminated from analysis.

BISON POPULATION NUMBERS

All alternatives, except alternative 1 (no action), employ population numbers to guide management actions. A "minimum viable bison population" for Yellowstone National Park may not be possible to define. However, information developed from research with private bison herds suggests that about 580 bison and a normal population sex and age structure are required to ensure random intermixing of breeding animals and avoid significant inbreeding (Knowles, unpub. data). All of the alternatives would preserve the genetic and biological integrity of bison in Yellowstone National Park by maintaining the bison herd at population levels considerably greater than 580 bison. None of the alternatives is intended to reduce the herd to that level, and, in all alternatives, lethal control measures would cease well before the herd has been reduced to 580 bison.

Population models suggest that the maximum number of bison that can live year-long in Yellowstone National Park varies between 1,700 and 3,500 bison, depending on forage production and winter severity. All of the alternatives are intended to maintain a viable bison herd in Yellowstone National Park. During periods of natural or management-induced population declines and as bison numbers approach 1,700, the agencies would more aggressively employ nonlethal methods to encourage bison to remain within management boundaries. Lethal controls would be employed only to remove those bison that pose the greatest risk of brucellosis transmission. Bison also might be held for extended periods in capture facilities for subsequent return to the park.

MANAGEMENT AS A WILD, FREE-RANGING POPULATION

The agreed-upon purpose of taking action is to "maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana." Therefore, each alternative sustains a

wild, free-ranging bison population over the long term, although the degree to which each fulfills this goal varies. A wild, free-ranging bison is defined as one that is not routinely handled and that can move without restrictions within specific geographic areas.

None of the alternatives envisions a "no management" strategy, that is, letting bison roam wherever they want with no agency actions to minimize the risk of brucellosis transmission to cattle. Doing so would be inconsistent with the purpose and need for implementing a long-term, cooperative bison management plan (see "Objectives in Taking Action" section of the "Purpose of and Need for Action"). Rather, each alternative features different levels of "hands-on" management actions to reduce sero-prevalence in the bison population. However, as described above, even during the periods of most active management, each alternative ensures that a viable population of bison is allowed to range over large areas of Yellowstone National Park.

In some alternatives, bison are captured and tested for exposure to brucellosis. Extraordinary measures, which would include the over-wintering of captive bison in agency capture facilities to prevent population numbers from dropping below those required by a particular alternative, would entail a temporary loss of the wild, free-ranging status of the captive animals.

BRUCELLOSIS CLASS-FREE STATUS

As previously stated, the purpose of taking action is to maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana. Both the risk of transmission and the economic interest and viability of Montana livestock figure heavily into the state's class-free status. Protecting the state of Montana from a reduction of its status (an objective of taking action) requires actions that ensure, among other things, separation of bison and cattle, ensuring that livestock that graze on public and private lands are not exposed to the *Brucella* organism, and implementation of bison management actions that minimize the risk of transmission from a disease perspective. The agencies have made a commitment to the eventual elimination of brucellosis from the Greater Yellowstone Area. This commitment is also a stated objective to which each alternative must be responsive.

Although each alternative meets these objectives, they do so to varying degrees. The distinction among the alternatives lies in the specific actions proposed and the varying methods and adequacy of ensuring these objectives are accomplished (see table 9 in "How Alternatives Meet Stated Objectives").

BISON DISTRIBUTION LIMITS

All alternatives include a management boundary that defines a certain distribution of bison. While the location of the boundary and the blend of management actions differ, in all alternatives, agency actions within the boundary are intended to prevent the movement of bison beyond the boundary. When bison move beyond the designated management boundary, agency personnel may haze bison back into the management area. Hazing may employ a variety of methods including noise, rubber bullets, cracker shells, dogs, and baiting. Hazing may take place on foot, on horseback, in vehicles, or by air. If bison cannot be hazed back into the management area, they may be shot.

Yellowstone National Park extends into the state of Montana along the park's northern and western border. Three specific entries from the park in this area are of concern, and measures to prohibit or restrict bison movement are in place at these entry points in all alternatives (see Bison Winter Movements map). Two entries lie along the northern boundary near the northwestern corner of the park — one a direct approach from the park into the town of Gardiner or across the boundary at Reese Creek onto private land, and the other farther east through the Eagle Creek/Bear Creek drainage. The third entry is

along the west side of the park in the general vicinity of the town of West Yellowstone.

Two additional boundary areas are mentioned in the alternatives. One is the combined Monument Mountain Unit of the Lee Metcalf Wilderness and Cabin Creek Wildlife and Recreation Management Area on the west side of the park and north of West Yellowstone (generally north of Grayling Creek/Fir Ridge). Land use in this area emphasizes wildlife and precludes domestic livestock. The other, which includes Hellroaring Creek and Slough Creek drainages in the Absaroka-Beartooth Wilderness lies along the northern boundary of the park to the east of the Eagle Creek/Bear Creek drainage. Both Hellroaring Creek and Slough Creek drainages are geographically isolated from areas with permitted cattle. In most alternatives, bison are allowed into Lee Metcalf/Cabin Creek and Hellroaring and Slough drainages, although very few are able to traverse the rugged terrain and deep snow in the winter.

BISON CAPTURE

The agencies have included capture facilities to help keep bison from moving across the boundaries in all alternatives except alternative 2. Bison are either herded into the facility with fences and hazing, or they are baited to enter. Captured bison are card tested for exposure to *B. abortus*, and either slaughtered, quarantined, or released depending on serological status, pregnancy status, population numbers, and the alternative. The size of the capture facility would vary with location, but siting criteria always include at a minimum the following:

- Holding pastures, corrals, handling equipment, and wing fences would be temporary structures.
- Capture facilities would use existing roads inside the park and to the extent practicable outside the park.

Brucellosis card test, 1997.

- Adequate water for captured bison, and hay if animals are kept longer than 24 hours, would be available.
- Ground disturbance would be kept to the minimum needed to properly construct the facilities.
- Facilities would be located in areas that do not contain significant wetland and riparian areas, or endangered, threatened, rare, and sensitive plant or animal species.
- If sited on U.S. Forest Service land, the location of the facility would be such that it meets the visual quality objectives of the *Gallatin National Forest Plan*.
- Natural and cultural resource surveys to comply with applicable laws would be completed before the facilities were built. Facilities would be located to avoid known sensitive or important cultural and natural resources.
- Facilities would be constructed and operated in such a manner that capture and handling of bison would be as humane as possible.

HUMANE TREATMENT OF BISON

The agencies are concerned with humanely managing bison (see appendix F for a summary of bison management techniques). Female bison and calves usually travel in groups of 25 to 30.

At the Stephens Creek capture facility, the entire group is directed by wing fences and by NPS personnel moving bison slowly and quietly on foot into a large pasture adjoining the capture facility. A few agency personnel may occupy catwalks overlooking the compound to help in moving groups of bison into corrals or chutes for testing. Battery-operated cattle prods to administer electric shocks are used only sparingly. Captured bison are separated into different sex and age groups, and older bulls are not commingled, if possible, with other bison for safety reasons. A recent evaluation by veterinarians and members of the Humane Society of the United States indicated directing fewer animals into the capture facility at one time may reduce stress and injuries to the bison (letter from Humane Treatment Evaluation Team to Gov. Marc Racicot, Feb. 3, 1997). This same evaluation indicated fewer personnel on the catwalks as bison are being driven toward the facility may be helpful as well.

Bison destined for slaughter would be shipped to one of five slaughterhouses in the state of Montana, all within a 160-mile radius of the Stephens Creek capture facility. The humane treatment team suggested all open grid fences used to direct bison into trucks for shipment be covered so the animals do not catch and rip their horns. The team also advised it would be more humane to shoot bison at the capture facility, rather than transport them live to slaughter. "While gunshots to the brain may be aesthetically unpleasant to some individuals," the report notes, "unconsciousness is instantaneous" if the procedure is performed by skilled personnel.

Agencies provide water at the capture facilities if bison are held less than 24 hours, and both water and food if they are held longer. The humane treatment team found this treatment adequate.

The team concluded that, while some changes could be made in the capture operation, "NPS had made a considerable effort to minimize any fatalities and injuries to the bison."

MONITORING

All alternatives follow the same monitoring schedule as bison move toward and outside the boundaries. As they approach Yellowstone National Park boundaries from inside the park in the winter, bison are monitored once per week. As they get closer to the boundary areas on the north and west, monitoring is increased to daily during winter months (November 1 to April 30). On the north side, the boundary is identified as the Reese Creek area. If bison move beyond this boundary, their movements may be monitored daily. On the west side, bison are monitored once per week when they are traveling along the Madison River inside the park, and daily as they move into the West Yellowstone area. Once outside the park in the western boundary area, they may be monitored as frequently as three times per week. Monitoring activities would include aerial or ground reconnaissance of individual bison or groups of bison. In the Eagle Creek/Bear Creek area, bison are monitored twice per week during the winter. If bison move toward the Little Trail Creek/Maiden Basin hydrographic divide and Gardiner, their movements are monitored daily.

Bison may also be monitored during other times of the year, but little movement outside the park is expected during June 1 to October 1.

SPECIAL MANAGEMENT AREA

All alternatives (except alternative 5) allow some bison outside the park and envision the creation of special management areas. A special management area is an area contiguous to the park where some or all bison may be tolerated for part or all of the year, as specified in the selected alternative, without increasing the risk of brucellosis transmission to domestic livestock. SMAs and the management within them vary within an alternative and between alternatives. Adequate disease control measures taken within these SMAs would protect Montana's brucellosis class-free status. The risk of transmission is managed in various alternatives through spatial separation of bison and cattle,

temporal separation, changes in cattle operations (such as running steers or spayed heifers), disease control in cattle or bison, or a combination of these factors. APHIS has indicated that any of the bison management plans (alternatives) in this environmental impact statement would be sufficient to prevent the actual outbreak of disease in domestic livestock and the subsequent spread of brucellosis. Therefore, it would not initiate a downgrade of Montana's class free status based on the mere presence of Yellowstone bison migrating out of the park into the SMAs in accordance with the selected bison plan (alternative). APHIS has also indicated that no changes in the current requirements for obtaining class-free status (Title 9, *Code of Federal Regulations*, Part 78) would be required for the agencies to establish SMAs.

Pursuant to statutory and regulatory requirements, the establishment, modification, or revision of SMAs requires the approval of the state of Montana as specified by Montana law. These decisions regarding SMA designation, modification, or revision will be based on the best science and information available, including bison management circumstances of the area.

DISTRIBUTION OF CARCASSES

Bison that are captured and test positive for exposure to *B. abortus* are slaughtered (a few may be used for research purposes). Those that cross the designated management boundary or evade capture may be shot. Seropositive bison are not slaughtered at the capture facility, but are trucked to slaughterhouses in the state of Montana within a 160-mile radius of the capture facility.

Under Montana statute (81-2-120, MCA) wild bison "that are certified by the state veterinarian as brucellosis-free may be transferred for full or partial compensation." Accordingly, meat from slaughtered animals is distributed to social service organizations, tribal governments, or is auctioned to help defray state costs of capture and slaughter. In 1997 the state received $185,763 from the sale of bison products, which partially offset its operating costs for bison management activities of $245,703. Heads and hides may be auctioned or released to tribal governments. Some bison that are shot are gutted and dressed by tribal members, who keep meat, heads, and hides. Otherwise, most bison are sent to slaughterhouses. Carcasses may also be left inside park boundaries to serve as a source of food for wildlife in any of the alternatives.

DISTRIBUTION OF LIVE BISON

Live bison are only available for release outside the area if they have successfully completed an APHIS-approved quarantine protocol. Occasional live bison may be used for research purposes.

PRIVATE LAND

Under Montana statute (81-2-120, MCA), the Department of Livestock with assistance from other agencies removes bison known or suspected to be carrying a disease on public land or, with landowner permission, on private property. If private landowners want bison removed from their property, the landowner must contact the Department of Livestock and allow ample time to respond. If the Department of Livestock does not respond to the landowner's request, the landowner may shoot the bison, but must contact the department to report the shooting and must retain the carcass for distribution by the department. Other agencies may assist in the effort at the request and with permission of the Department of Livestock.

VACCINATION

All alternatives include the suggested vaccination of female cattle calves in higher-risk areas, e.g., those adjacent to the park or to the SMAs. Vaccination of cattle against brucellosis remains a common practice in Montana and other areas across the country. However, because vaccination of cattle does not provide 100%

immunity against the disease, vaccination alone will not prevent the transmission of the disease from an infected animal. Within high-risk areas, the Department of Livestock requires surveillance testing of all test-eligible cattle coming into direct contact with bison. Testing requirements for those cattle occupying adjacent areas is conducted at the discretion of the Montana State veterinarian. If a herd is in contact with bison, test-eligible female cattle are tested. State animal health authorities would encourage calfhood (4–12 months old) vaccination with RB51 (the current vaccine for cattle) of all test-eligible cattle on private lands within a 20-mile radius of areas where bison are allowed (SMAs) and encourage vaccination on public lands within the SMA. The Animal and Plant Health Inspection Service would provide the vaccine for all cattle vaccinations required on public land performed within the SMA, although livestock operators would be responsible for costs.

In all alternatives, the agencies are proposing the use of a vaccine for brucellosis in the bison population. In alternatives 1, 2, 3, 4, and 7, vaccination of bison calves or captured adult bison would begin when a safe and effective vaccine is available. In alternatives 5 and 6, whole herd vaccination is planned.

A vaccine known to be safe and effective in bison and safe for nontarget species does not currently exist. The agencies have agreed that a safe vaccine is one that has no long-term pathological effects on the vaccinated bison or its fetus, and no debilitating reaction that would increase mortality in the population. A safe vaccine would also be one in which the bacteria incurs no genetic mutations or reversions, and that causes no pathological effects, death, or disability in nontarget animals exposed to the vaccine or vaccinated bison.

Effectiveness, or efficacy, is the ability to impart protection from abortion and infection when exposed to brucellosis. To date vaccines protect better from abortion than from infection. The decision on when a vaccine is safe and effective "enough" is complex and depends on several factors. The decision to administer a specific vaccine would depend, in part, on the opportunity afforded by the selected management actions for a given location. For instance, bison already in a capture facility and being prepared for testing and marking (as sero-negative) may be vaccinated with a safe but relatively less effective vaccine than one slated for remote delivery or through a parkwide roundup and capture program. Research on the vaccine RB51 may show this or a similar strain to be appropriate for the former situation. Also, a vaccine with a relatively high efficacy rate that could be broadcast for oral administration in bait, but which offered a potential hazard to a native nontarget species, might be used if that hazard could be eliminated through timing or method of administration. Therefore, the decision on whether a particular vaccine is safe and/or effective will be made cooperatively and should be based on many factors.

When the National Park Service and the state of Montana agree that a vaccine is safe for bison and nontarget species, and the vaccine is at least somewhat effective in protecting vaccinated bison from infection, the agencies would determine when and where, within the approved management plan, that vaccine might be used. The agencies would review ongoing vaccine research results and assess the consequences of using vaccines as they are developed. If vaccine characteristics require it, the National Park Service and the state of Montana would complete the appropriate environmental review (according to state and federal laws) before administering the vaccine.

RESEARCH EFFORTS

Research is underway now and will continue during implementation of the selected management alternative. Research topics include, but are not limited to, testing and development of a safe and effective vaccine for bison, studies on the epidemiology and pathogenesis of *B. abortus* in bison, bison-specific blood tests for the exposure to *B. abortus* and presence of brucellosis, risk assessment of brucellosis transmission from bison to cattle in a wildland

setting, and the use of groomed roads and trails by bison (see appendix D). Agencies would use the information from these research efforts to review pieces of the plan as appropriate. Whole bison carcasses and/or blood and tissue samples would be collected from bison for the purposes of disease surveillance, and for research to increase understanding of *B. abortus* in bison. Live seronegative bison may be obtained from winter capture operations for approved research.

Tissue samples would be collected from all seronegative-pregnant bison killed during management operations. Sampling protocols would be based on those developed by the GYIBC. The agencies, including APHIS Veterinary Services and the Biological Resources Division of the U.S. Geological Survey, with assistance from the Montana Departments of Livestock and Fish, Wildlife and Parks and the National Park Service, would provide qualified personnel to conduct necropsies and collect tissues. Test results would be provided to all cooperating agencies.

ALTERNATIVE 1: NO ACTION – CONTINUATION OF THE CURRENT INTERIM BISON MANAGEMENT PLAN

Adopting this alternative would continue current bison management as set forth in the 1996 *Interim Bison Management Plan.* NEPA guiding regulations (40 CFR 1502.14) define the no-action alternative in a plan as "no change from current management direction or level of management intensity," and state that an alternative based on no management at all is often "a useless academic exercise." (Although the 1996 plan was modified by state and federal agencies to maintain a generally stable bison population during the winter of 1997–98, the no-action alternative does not consider those modifications. Instead, the environmental impact statement assumes bison management actions, environmental conditions, and other relevant factors are as they were in spring 1997 when work on this environmental impact statement began. Appendix A includes the evaluation and state and federal decision documents on adjustments to the *Interim Bison Management Plan.*)

The interim plan relies on strict border enforcement to keep bison and cattle separate, and has no provision for quarantining bison. Bison are prevented from crossing the northern park boundary at Reese Creek because the adjacent land is private and occupied by cattle throughout the year. Bison are allowed in the Eagle Creek/Bear Creek area.

In the West Yellowstone area, public lands are adjacent to the park. Cattle are more dispersed than at Reese Creek and are not grazed during the winter months. Up to 200 bison in Eagle Creek/Bear Creek, and 50–100 in the West Yellowstone area have been able to overwinter successfully outside the park without coming in contact with cattle. Bison located outside the park in the west boundary area would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. In addition, a handful of bison (usually single bulls) use the Lee Metcalf/Cabin Creek area on the west, or Hellroaring and Slough drainages to the north and east of Eagle Creek/Bear Creek. Those few bison that move beyond the borders of either of these large tracts of forest land would be hazed or shot.

NORTHERN BOUNDARY

Reese Creek

Private property (the Royal Teton Ranch) abuts the Yellowstone National Park boundary at Reese Creek. Through a lease with property owners, approximately 250 cow-calf pairs graze in the Gardiner Valley during the winter from the Corwin Springs bridge for about 8–9 miles to the north end of the property just south of Yankee Jim Canyon (see Alternative 1 map). A capture facility inside the park at Stephens Creek is within 2 miles of Reese Creek, and operates from November 1 to April 30. Wing fences and agency personnel guide bison toward the facility when they are approaching the park boundary. Bison not captured cross the property where they are hazed back into the park or shot.

The Stephens Creek capture facility (see Alternative 1 map) occupies 13 acres, and includes four pens to separate bison, two holding pastures (one large and one small), and chutes to help direct bison. It is adjacent to a park horse corral, receives water and electricity, and is easily accessible by dirt road. All captured bison are divided into groups for safety reasons, held for a few hours (or occasionally for one to two nights), and shipped to slaughter. A few might be used for research purposes.

Stephens Creek capture facility.

Eagle Creek/Bear Creek

About 23,000 acres of bison winter habitat are located on the Gallatin National Forest in the Eagle Creek/Bear Creek area bordering Yellowstone National Park to the north and east of Gardiner. Bison are able to occupy portions of these lands during the winter (and summer, although most migrate back into the park in May and June). In this alternative, agency personnel would maintain a boundary at the Little Trail Creek/Maiden Basin divide by hazing or shooting bison that crossed it. In average winters, no bison approach this boundary.

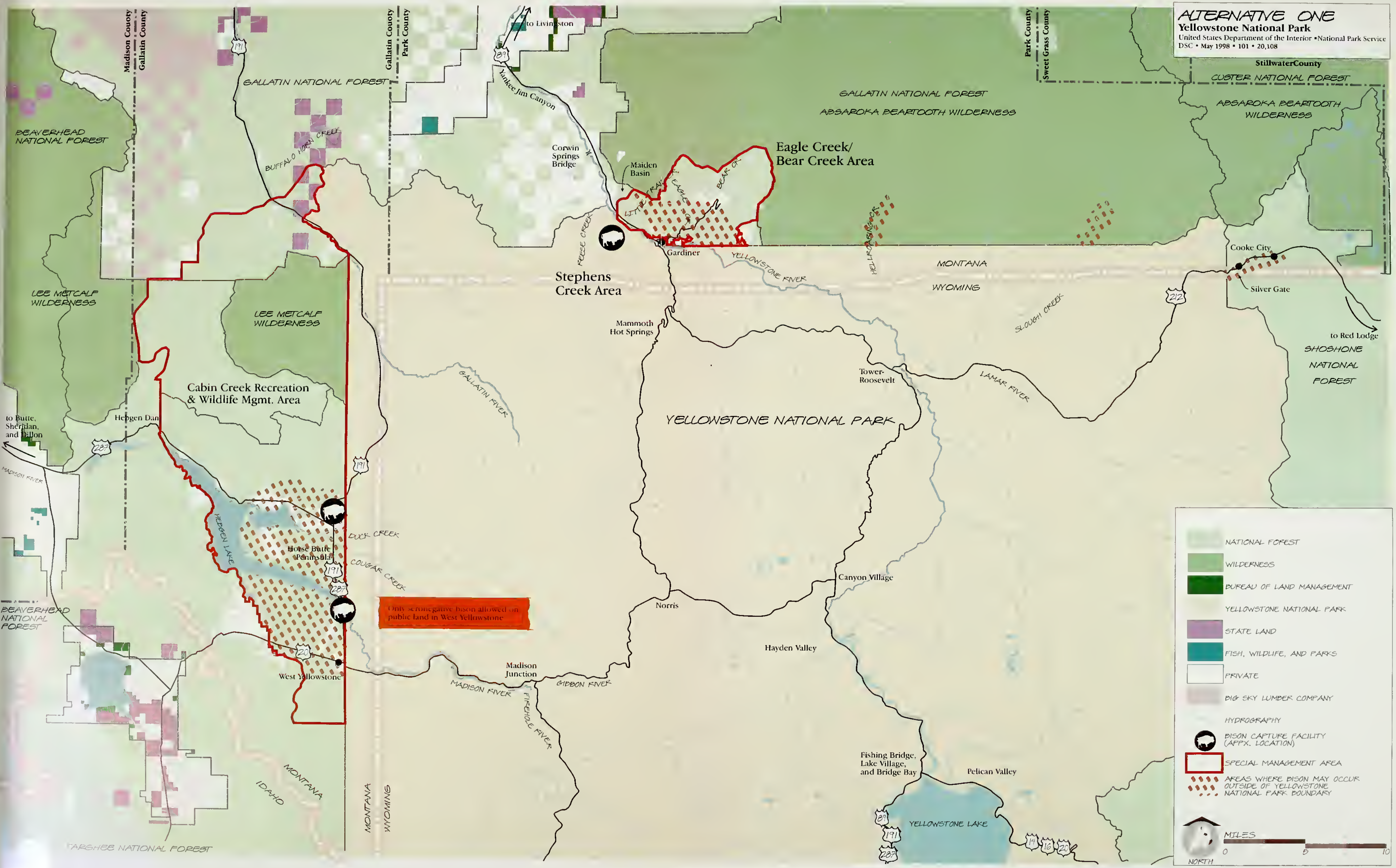
WESTERN BOUNDARY

Bison migrate out of Yellowstone National Park along the Madison River corridor, traveling along groomed roads or bison trails inside the park and feeding at riverbanks and pools warmed by thermal features. Most leave by way of Duck and Cougar Creeks to the north of Madison River and travel west to the national forest in the 24,000-acre Horse Butte area. Some of these lands are forested, but the bison prefer open areas where they can find forage under the snow.

The public land outside the park on the west side is intermixed with private holdings, and bison might be shot at any time on private land under the conditions described in the "Actions Common to All Alternatives." No cattle are grazed in this area in the winter, and bison are hazed back into park boundaries in May, well before cattle appear in the summer. Under the provisions of this alternative, bison would be hazed back into the park in the spring 30 to 60 days before cattle occupy land in the area west of the park. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. The scheduled on-date for cattle on Horse Butte is June 15, and for other allotments in the West Yellowstone area is July 15. Cattle can occupy private land at any time; however, they normally are present from about June 1 to November 15.

Two capture facilities smaller than the one at Stephens Creek are also operated by the Department of Livestock from November 1 to April 30 outside the western park boundaries. One is located on private land in the Duck Creek area, about 100 yards from the park boundary. The second is near the Madison River on Gallatin National Forest land. Each facility occupies about 1 acre, and relies primarily on "opportunistic" methods of capturing bison, e.g., baiting with hay. Both facilities have three pens for sorting, as well as a capture pen and hydraulic chutes. Captured bison are blood tested for exposure to *B. abortus*, and all seropositive bison are shipped to slaughter. Seronegative-nonpregnant females and all seronegative males are identified with a metal ear tag and a temporary visual marker, and are shipped to and released on public lands in the West Yellowstone area. Seronegative-pregnant bison are shipped to slaughter. All bison evading capture on public lands are shot. Those evading capture on private lands are shot at the request of or with permission of the landowner. Capture facilities could be relocated to take advantage of changing bison migration routes under this alternative using criteria outlined in the "Actions Common to All Alternatives."

Bison are able to occupy the Cabin Creek Recreation and Wildlife Management Area and Monument Mountain Unit of the Lee Metcalf Wilderness on the west side of Yellowstone National Park without agency management, as


ALTERNATIVE ONE
Yellowstone National Park
United States Department of the Interior •National Park Service
DSC • May 1998 • 101 • 20,108
Madison County
Gallatin County
Park County
Sweet Grass County
Stillwater County
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
LEE METCALF WILDERNESS
BUFFALO HORN CREEK
to Livingston
Yankee Jim Canyon
Corwin Springs Bridge
Maiden Basin
Eagle Creek/ Bear Creek Area
Stephens Creek Area
Gardiner
YELLOWSTONE RIVER
MONTANA
WYOMING
Cooke City
Silver Gate
to Red Lodge
SHOSHONE NATIONAL FOREST
SLOUGH CREEK
LAMAR RIVER
Mammoth Hot Springs
Tower-Roosevelt
YELLOWSTONE NATIONAL PARK
GALLATIN RIVER
Cabin Creek Recreation & Wildlife Mgmt. Area
Hebgen Dam
to Butte, Sheridan, and Dillon
MADISON RIVER
HEBGEN LAKE
Horse Butte Peninsula
DUCK CREEK
COUGAR CREEK
Only seronegative bison allowed on public land in West Yellowstone
West Yellowstone
Madison Junction
MADISON RIVER
GIBBON RIVER
FIREHOLE RIVER
Norris
Canyon Village
Hayden Valley
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
TARGHEE NATIONAL FOREST
MONTANA
IDAHO
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
BISON CAPTURE FACILITY (APPX. LOCATION)
SPECIAL MANAGEMENT AREA
AREAS WHERE BISON MAY OCCUR OUTSIDE OF YELLOWSTONE NATIONAL PARK BOUNDARY
MILES
0
5
10
NORTH

these are public lands without livestock allotments. These large tracts are north of the Horse Butte lands (north of Grayling Creek/Fir Ridge), and topography and snow depth usually limit the number of bison that actually use them. Steep, rugged territory prevents bison from exiting these lands to the west except by way of a narrow corridor around Hebgen Lake Dam. Private lands lie to the south and north. Agencies remove bison by hazing or shooting if they attempt to leave this designated management area by any of these three routes.

SPECIAL MANAGEMENT AREAS

Special management areas have not been officially designated in the operation of the interim plan. However, for the purposes of this environmental impact statement, the lands in the Eagle Creek/Bear Creek area up to the Little Trail Creek/Maiden Basin hydrographic divide, Hellroaring and Slough Creek drainages, the portion of West Yellowstone shown on the Alternative 1 map, and the Lee Metcalf/Cabin Creek area would function as SMAs — i.e., bison could enter them without endangering Montana's federal brucellosis class-free status (see "Special Management Areas" section of "Actions Common to All Alternatives"). For this reason, these areas are referred to as SMAs through the remainder of the description of this alternative.

Bison are and would continue to be allowed in the Eagle Creek/Bear Creek SMA year-round up to the boundary at Little Trail Creek/Maiden Basin hydrographic divide, although all but a few bulls return to higher elevation inside Yellowstone National Park in the spring. They are also allowed year-round access to and from Hellroaring and Slough Creek drainages, and the Cabin Creek/Lee Metcalf area.

Cattle would be grazed on public lands, primarily on the Horse Butte allotment in the West Yellowstone area in the summer months. Grazing on Horse Butte would take place from June 15 to September 15. For all other public allotments in the western SMA, the earliest cattle on-date would be June 15, and the latest cattle off-date would be October 15. Grazing on private lands could begin as early as May 1, but usually begins about June 1. Bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Seronegative-nonpregnant bison are allowed back into the West Yellowstone area following the departure of livestock (November 1).

RISK MANAGEMENT

The primary means to minimize risk of transmission from cattle and bison in this alternative would be the enforcement of controlled entry at the northern borders described above, and temporal separation at the western border on public lands. At Reese Creek, this would include monitoring, hazing, capture and slaughter, and agency shooting. At Eagle Creek/Bear Creek, monitoring, hazing, and agency shooting would be used to prevent entry via Little Trail Creek/Maiden Basin hydrographic divide into the Gardiner area. On the west end, hazing bison back into the park before summer would prevent them from mingling with cattle. Topography, availability of habitat, hazing, and agency shooting would also keep bison from moving beyond SMA boundaries.

In addition to maintaining separation of cattle and bison, other measures would be aimed at reducing the risk of transmission. For example, seronegative-pregnant bison in the western SMA would be slaughtered. This is because bison could test seronegative and be carrying the disease organism. This usually occurs when they have recently become exposed and are in the incubation stage of the disease. In particular, female bison infected *in utero* might show no signs of the disease until the third trimester of their first pregnancy, when hormones trigger the release of the bacteria into the uterus and other reproductive tissues and fluids. Bison fetuses and birth tissues aborted on cattle-use areas in

winter and remaining until spring might pose a risk of transmission to cattle that return to the area in summer.

Cattle operators in the western SMA or adjacent areas on private lands would be strongly encouraged to vaccinate female calves against brucellosis (see the "Vaccination" section of "Actions Common to All Alternatives") with RB51 or other approved vaccine. Cattle herds in these "contact" areas would continue to be surveillance tested, and any herd whose members might have been in contact with bison would be checked for exposure and revaccinated as adults. Livestock owners on private property would continue to be responsible for all costs and materials associated with vaccination.

When a safe and effective vaccine was developed for bison, it would be administered in capture facilities to bison testing negative. It might also be delivered through remote means to bison inside Yellowstone National Park.

POPULATION MANAGEMENT

No actions specifically to control population numbers on either end of the range are built into this alternative. However, it is anticipated that more bison would attempt to migrate outside the park in response to winter severity when numbers were high, and would be captured, slaughtered, or shot. Therefore, this alternative relies on natural forces inside the park and lethal boundary enforcement to keep population numbers from increasing beyond the upper end of the 1,700–3,500 range.

Allowing bison to use the Eagle Creek/Bear Creek area during the winter would sustain between 100 and 200 animals, with good to excellent range condition objectives (*Gallatin National Forest Plan*, p. G-14). The present plan includes a provision that agencies would develop contingencies for ensuring the integrity of the bison herd should numbers drop. However, the interim plan provides no direction for specific contingency measures.

ESTIMATE OF COST

Table 2 indicates the costs that would be incurred by the interagency team for alternative 1.

Table 2: Annual Cost/Income Estimates – Alternative 1

	National Park Service	U.S. Forest Service	State of Montana	APHIS
Capture facilities[1]	$120,000		$175,000	$50,000
Test/sample				25,000
Operations (hazing, shooting, monitoring, supplies, equipment)	180,000	$15,000	150 ,000 (1996) – 270,000 (1997)	100,000
Vaccination	150,000			8,000
Average income from the sale of meat, hides, and heads			+35,000 to +185,000	
TOTALS	($450,000)	($15,000)	($140,000 – $420,000)	($183,000)

1. One time only (costs for existing facilities at Stephens Creek and western SMA have already been incurred).

The purpose of this alternative is to restore as near-natural conditions as possible for bison, including a small portion of their historic nomadic migration patterns. The area outside Yellowstone National Park over which bison would be able to range (e.g., the special management areas) without agency management is the largest of all alternatives (see Alternative 2 map).

Some features of alternative 2, notably the acquisition, through purchase or easement or changes in cattle operations from willing sellers, of additional winter range for bison, and the vaccination of bison, involve unknowns and/or additional environmental compliance and review. A vaccine the agencies agree is both safe and effective for bison and safe for nontarget species does not currently exist, and the administration of a vaccine requires agreement from the agencies as well as possible environmental compliance, public input, and review. Creation of SMAs to allow bison outside the park would require the approval of the state of Montana as specified by Montana law. This is also true for alternatives 3, 4, 6, and 7.

This alternative focuses on changes in cattle operations for ranchers in the SMAs as the primary means to minimize the risk of disease transmission. This could only take effect if ranchers were willing to sell land or easements, or receive compensation for changes in their existing cattle operations. Determining which lands were appropriate for such changes, which owners were willing to sell, and negotiating compensation would take time.

It is impossible to know for sure whether or which land would be acquired, when a safe and effective vaccine for bison would be available, or whether an SMA would be approved on land outside the park designated as appropriate for winter range. However, for purposes of analysis, this environmental impact statement assumes certain dates when these events would occur. If these dates were not met, the consequences of this alternative might be slightly different than that disclosed in the "Environmental Consequences" part of this document.

This environmental impact statement assumes a safe and effective vaccine for bison would be available and administered parkwide beginning in the year 2000 (or two years from the date the record of decision is signed). It also assumes any state approvals required to create SMAs would be immediately forthcoming.

Because of the complexities inherent in the acquisition of property or easements, or compensation for changes in cattle operations, this environmental impact statement assumes such changes would not be completed until 2003 (or five years from the date the records of decision are signed). For purposes of analysis only, the provisions of the interim plan are assumed to continue until acquisition is completed. This period (when the interim plan is in effect) is referred to as phase 1 of this alternative.

Despite these assumptions for analysis purposes, it is likely that, should some lands be acquired, bison would be allowed on them while others were the subject of continuing negotiations. This would be true of other factors as well. For instance, a safe and effective vaccine would be applied when it was available and compliance was completed, regardless of whether this was earlier or later than the year 2000.

When appropriate acquisition was completed or cattle operation changes were made (referred to as phase 2 of this alternative), lethal control would only be used where human health was in immediate danger, on private property at the request of the landowner, or outside the SMA border. Bison would not be captured or slaughtered by agencies, and all existing capture facilities would be dismantled. A key tool available to help control bison distribution and population size during phase 2 would be the

closure of groomed roads the animals now use to traverse and exit the park.

In addition to leaving road segments ungroomed, the agencies would be able to haze bison in some cases, and would maintain boundary lines through hazing and shooting in phases 1 and 2.

NORTHERN BOUNDARY

Reese Creek

While the interim plan is in effect, bison attempting to leave the park via the Reese Creek boundary would be captured and shipped to slaughter or shot on private land as they are now.

When appropriate acquisitions to the north of the park's Reese Creek boundary were completed, the National Park Service would dismantle its capture facility at Stephens Creek and would not maintain any boundary control at the northern border of Yellowstone National Park.

Bison movement would be monitored from November 1 to April 30, but bison would not be hazed. Within the park, selected roads would be closed or not groomed for snowmobile travel during winter.

The Department of Livestock, with help from other agencies, would maintain a boundary at Yankee Jim Canyon (see Alternative 2 map), about 12 miles north of the current park border at Reese Creek. Yankee Jim Canyon is a narrow part of the Yellowstone Valley located on national forest land, and agencies would enforce the boundary through hazing and shooting. The majority of land in the valley bottom north of Yankee Jim Canyon is privately owned.

Eagle Creek/Bear Creek

Under the interim plan, bison attempting to cross the Little Trail Creek/Maiden Basin hydrographic divide and travel onto private property in the Gardiner Valley are shot by agencies. This would continue until appropriate acquisitions or changes in cattle operations were made. When they were made, bison would not only be allowed to freely roam in the Eagle Creek/Bear Creek area, but also the Little Trail Creek/Maiden Basin hydrographic divide. Agencies would not maintain any boundary at this entry into the Gardiner area.

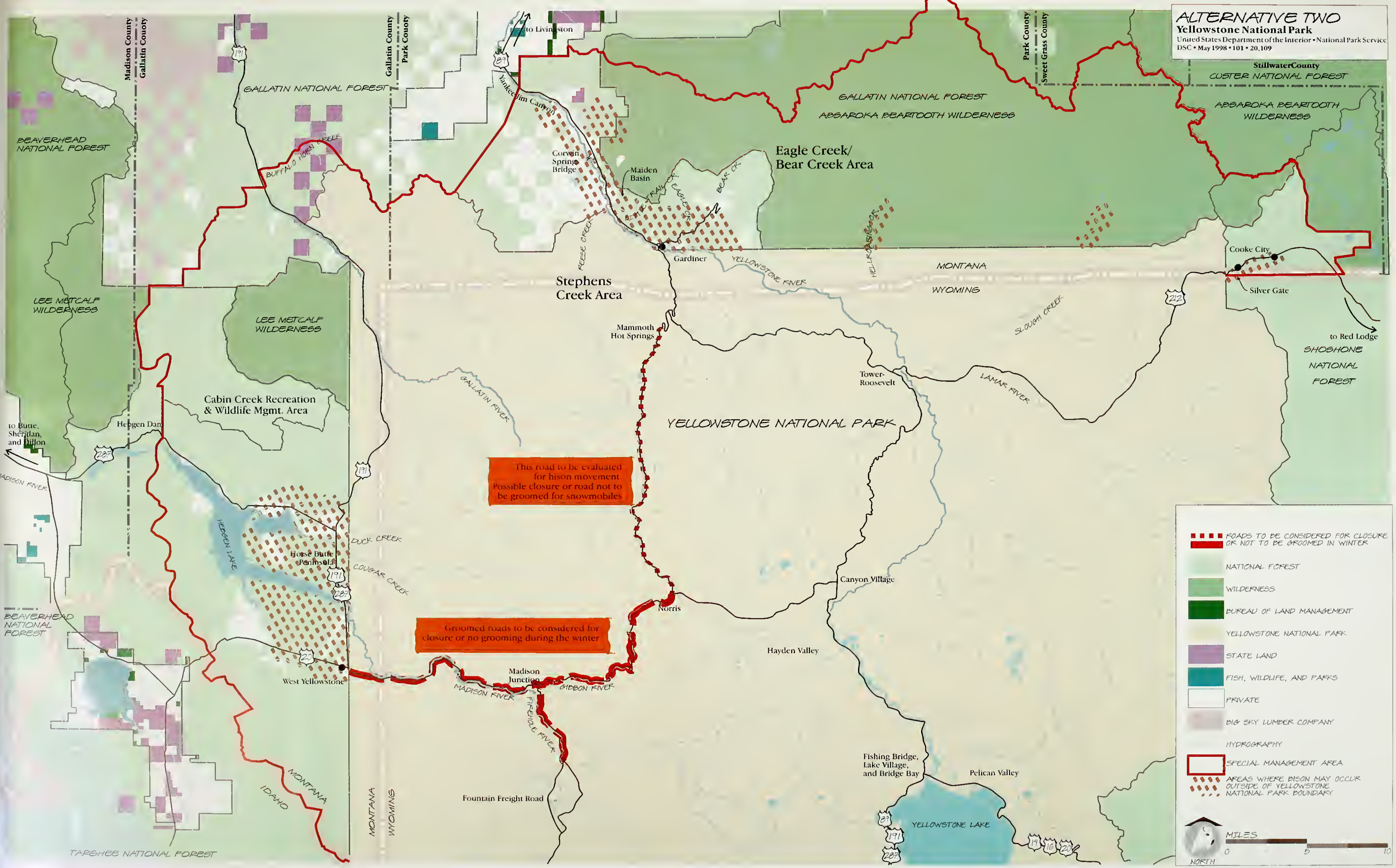
WESTERN BOUNDARY

While the interim plan was in effect, bison would be captured and tested in capture facilities in the western SMA. Seronegative-nonpregnant bison would be released onto public lands outside the park for the winter, and hazed back into the park in May to avoid conflicts between bison and cattle that would be entering national forest grazing allotments for the summer. Agencies would maintain a northernmost boundary in the western SMA in the Cabin Creek Recreation and Wildlife Management Area.

When allotments have been changed and/or private cattle operations modified, this boundary would be moved north to Buffalo Horn Creek (see Alternative 2 map) on the northwest side of the park. This would add some federal lands north of the Lee Metcalf Wilderness to the western SMA, and establish a boundary to keep bison from occupying private lands to the northeast. Bison movements would be monitored both as they moved toward the park boundary on the west side in the winter and in the SMA. Bison crossing the boundary at Buffalo Horn Creek would be hazed back into the management area or shot. Those leaving to the west along Hebgen Lake Dam would also be hazed or shot. Capture facilities in the western SMA would be dismantled, as this alternative would not include any capture or slaughter by agencies in phase 2.

SPECIAL MANAGEMENT AREAS

During phase 1, while the interim plan was in effect, bison would be allowed to range outside the park in areas described in alternative 1, including the Eagle Creek/Bear Creek area; the


ALTERNATIVE TWO
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • May 1998 • 101 • 20,109
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
BEAVERHEAD NATIONAL FOREST
LEE METCALF WILDERNESS
LEE METCALF WILDERNESS
Cabin Creek Recreation & Wildlife Mgmt. Area
Eagle Creek/ Bear Creek Area
Stephens Creek Area
YELLOWSTONE NATIONAL PARK
SHOSHONE NATIONAL FOREST
TARGHEE NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
Madison County
Gallatin County
Park County
Sweet Grass County
Stillwater County
MONTANA
WYOMING
IDAHO
This road to be evaluated for bison movement. Possible closure or road not to be groomed for snowmobiles
Groomed roads to be considered for closure or no grooming during the winter
Gardiner
Mammoth Hot Springs
Tower-Roosevelt
Cooke City
Silver Gate
to Red Lodge
Canyon Village
Norris
Madison Junction
West Yellowstone
Hayden Valley
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
Fountain Freight Road
Hebgen Dam
HEBGEN LAKE
Horse Butte Peninsula
to Butte, Sheridan, and Dillon
to Livingston
Yankee Jim Canyon
Corwin Springs Bridge
Maiden Basin
YELLOWSTONE RIVER
GALLATIN RIVER
MADISON RIVER
GIBBON RIVER
FIREHOLE RIVER
LAMAR RIVER
SLOUGH CREEK
DUCK CREEK
COUGAR CREEK
BUFFALO HORN CREEK
REESE CREEK
BEAR CR.
EAGLE CR.
HELLROARING CR.
ROADS TO BE CONSIDERED FOR CLOSURE OR NOT TO BE GROOMED IN WINTER
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
SPECIAL MANAGEMENT AREA
AREAS WHERE BISON MAY OCCUR OUTSIDE OF YELLOWSTONE NATIONAL PARK BOUNDARY
MILES
0
5
10
NORTH

Absaroka-Beartooth Wilderness north of the park, including the Hellroaring and Slough Creek drainages;, and the West Yellowstone area, Cabin Creek Recreation and Wildlife Management Area, and Monument Mountain Unit of the Lee Metcalf Wilderness west of the park. Agencies would maintain boundaries at Reese Creek and the Little Trail Creek/Maiden Basin hydrographic divide, and would capture or shoot bison crossing these boundaries and on private property. Carcasses would be retrieved by the Department of Livestock and distributed as described in the "Actions Common to All Alternatives."

The agencies would attempt to acquire winter range and expand the SMAs to include what are now private lands between Reese Creek and Yankee Jim Canyon on both sides of the Yellowstone River. They might also offer incentives to change livestock operations, acquire winter range from willing sellers, or modify grazing allotments in the western SMA.

Following acquisition through purchase or easement, or appropriate changes in cattle operations, capture facilities would be dismantled and bison allowed to range freely. The northern boundary would move north to Yankee Jim Canyon, and the north edge of the western SMA would shift north to Buffalo Horn Creek.

In the western SMA, bison would no longer be hazed back from the West Yellowstone area into the park in May. Most of these bison return to the park on their own in late spring, and agencies would expect only a few, if any, to stay behind.

If needed, agencies would haze remaining bison from private to public land in the SMA.

RISK MANAGEMENT

The primary means to minimize risk in this alternative would be those used to maintain the separation of cattle and bison. These include the provisions of the interim plan described in alternative 1 for phase 1, and changes in livestock operations and the return to ungroomed conditions of certain key sections of park roads in phase 2 of this alternative.

On private land in the SMAs, which now is used for cattle grazing or other livestock operations, agencies might offer incentives to change operations so susceptible cattle were removed. Nonbreeding cattle, such as steers or spayed heifers, would not transmit the disease if they were infected through contact with bison. Brucellosis is spread primarily through ingestion of reproductive fluids and birth materials from infected cows. Therefore, convincing operators to change management practices to raising nonsusceptible livestock such as steers would eliminate the risk of spreading the disease. Also, procurement of access to winter range by acquiring grazing rights, easements, or outright purchase of property from willing sellers could be used to remove cattle altogether on private property in the designated SMAs. Until these measures were in place, agencies would maintain boundaries as described above (see "Special Management Areas" section) and capture and test on the west side. Seronegative bison would be released, and seropositive bison would be shipped to slaughter, as they are now.

The agencies would seek agreements with grazing permittees to modify grazing allotments on the national forest where bison might roam. Potential modifications include working with permittees to change class of livestock or operations so that there would be no conflict between cattle and bison, close allotments and move cattle to areas where bison are never present, or other modifications to minimize exposure of susceptible cattle to bison.

The National Park Service would modify its winter road management plan to eliminate winter grooming and snowmobile use of some roads in Yellowstone National Park. Bison have "discovered" these pathways, and routinely use them in the interior of the park to avoid traversing areas of deep snow. It is hypothesized that the energetic cost of traveling these roads is low, and that bison using them are more likely to

survive the winter than those who do not use them. In other words, they are made to pay what some believe is "the true cost" of travel. Some bison also could be accessing areas of the park near its borders because of groomed trails and plowed roads.

Bison herd along road in Yellowstone National Park in the winter.

Alternative 2 is the only alternative to propose routine changes in some segments of park roads to control distribution, although other alternatives include research on the use of roads and potential barriers to bison travel (alternative 3), and/or plowing to access capture facilities (alternatives 5 and 6). Some changes in road grooming might occur in phase 1 of this alternative as well help control distribution (see discussion on bison distribution in the "Background" chapter of the "Purpose of and Need for Action").

Roads left ungroomed could include sections from Madison to West Yellowstone, Madison to Norris, and Madison to the Fountain Freight Road (see Alternative 2 map), which would isolate herds inside the park from boundary areas, and increase natural winter kill. The agencies would conduct research to determine the effectiveness of those closures in preventing bison from leaving the park during winter, and to evaluate the contribution of other groomed roads to bison movements out of the park. Based on those investigations, additional changes and NEPA compliance to further inhibit bison from leaving the park or to maintain bison population size are possible.

In addition to measures to ensure separation of cattle and bison, state animal health authorities would encourage livestock owners throughout the area whose cattle might come in contact with bison to vaccinate female calves (4–12 months old) against brucellosis with RB51 or other approved vaccine. Operators in boundary areas would be encouraged to annually vaccinate all subadult cattle as well as calves. Cattle herds in contact areas would continue to be surveillance tested periodically, and any herd whose member or members was in contact with bison would be checked for exposure to *B. abortus*. Livestock owners on private property would continue to be responsible for all costs and materials associated with calfhood vaccination.

When a safe and effective vaccine was developed for bison, it would be administered to bison inside Yellowstone National Park through remote means. Depending on the vaccine,

calves, yearlings, or possibly adults might be vaccinated as long as the vaccine was safe and effective.

POPULATION MANAGEMENT

No actions specifically to control or maintain population numbers, other than changes in road grooming described above, would be anticipated. It is expected that these changes would ultimately force more bison to experience the full brunt of natural processes, such as harsh winters and ongoing predation and competition, and would maintain the population within the natural range of 1,700 and 3,500 animals. However, it is unknown whether, or the degree to which, changes in road grooming would affect bison distribution. Allowing bison to occupy additional range beyond the park boundaries in the northern and western SMAs would help keep population numbers from falling below 1,700.

ESTIMATE OF COST

Table 3 indicates the costs that would be incurred by the interagency team for alternative 2.

TABLE 3: ANNUAL COST/INCOME ESTIMATES – ALTERNATIVE 2

	National Park Service	U.S. Forest Service	State of Montana	APHIS	Shared Costs
Test/sample				$22,000	
Monitoring	$25,000	$15,000			
Operations	57,000		$150,000		
Acquisition[1]		$65,000[2]			$44.1 million
Easement[1]					Unknown[3]
Conversion of livestock operations[1]					Unknown[3]
Vaccination	150,000			8,000	
Increased snowmobile enforcement		50,000			
Wildlife/winter use monitoring		25,000			
Allotment modification[1]		15,000[2]			
TOTALS	($232,000)	($170,000)	($150,000)	($30,000)	(Up to $44.1 million)

1. One time only.
2. Administrative costs (one time only).
3. Easement and conversion would substitute for acquisition, and costs would be less than $44.1 million.

Alternative 3 relies on the hunting of bison to regulate population numbers and distribution of bison outside the park, and on separation of bison in time and space to preclude contact with cattle. Where hunting was infeasible or inappropriate, capture and shipment of sero-positive bison to slaughter and seronegative bison to quarantine would used to maintain separation and manage the risk of disease transmission. As in other alternatives, bison would be vaccinated when a safe and effective vaccine was developed to further reduce this risk. This alternative has two phases. Phase 2 is a long-term strategy to manage bison through hunting, quarantine, and use of acquired land or easements for additional winter range and bison management options. Because many of these require additional permits, environmental review, or changes not within the complete control of the agencies, alternative 3 also envisions continuing appropriate features of the interim plan (alternative 1) until these features were in place. This is referred to as phase 1.

Alternative 3 includes the use of capture, test and slaughter, creation of SMAs, quarantine of some seronegative bison, hunting, vaccination of bison, acquisition of additional winter range, and creation of an SMA on that range as bison management tools. Vaccination of bison requires a safe and effective vaccine, which does not currently exist. Construction and operation of a quarantine facility would require environmental review and compliance, as well as a funding source and management entity. The acquisition of winter range, whether through purchase or easement or changes in cattle operations, is a time-consuming and uncertain process. In alternative 3 (as well as in alternatives 4 and 7), bison hunting is assumed; yet, this would require approval by the Montana Legislature, which does not convene until 1999. In addition to the inherent uncertainty of several of these factors, some management tools, such as the construction of a quarantine facility or use of a bison vaccine, would also likely require additional time for environmental review and compliance.

For purposes of analysis, each of these management tools or regulatory changes was assumed to occur by a certain date. If they occurred earlier or later, the impacts of alternative 3 could be slightly different than reported. Also, the mix of management tools could be slightly different than described herein, as agencies would use whichever tools are approved and available. The necessary changes in regulations to allow bison outside the park were assumed to be made immediately upon the agency decision to select an alternative (documented in both a state and a federal record of decision). Hunting was assumed to be approved by the legislature and to begin in 2000. The quarantine facility was assumed to be built and operating by 1999. A safe and effective vaccine was assumed to be available in the year 2000. Because less land was targeted for acquisition in alternative 3 than alternative 2, acquisition was assumed to be completed by 1999. Phase 1 in this alternative refers to the time prior to 1999.

Until land acquisition occurred (phase 2), the separation of cattle and bison on the northern (Reese Creek) boundary would be maintained through capture at Stephens Creek and the shipment of seronegatives to quarantine (or slaughter if the facility was not yet built) and seropositives to slaughter. The National Park Service now ships all bison captured at Stephens Creek (under the provisions of the *Interim Bison Management Plan*) to slaughter, as capture facilities were not designed to hold animals for more than a day or so. A quarantine facility would give the National Park Service flexibility in the disposition of seronegative bison it does not now have.

Bison that completed the full quarantine procedure would be shipped live to requesting tribes or organizations, or used to repopulate herds on public lands. The location, design, and operation of the facility has not been determined,

and would require subsequent MEPA/NEPA analysis, including public input, before any decision was made. Until the time a quarantine facility was constructed, bison captured at Stephens Creek would be sent to slaughter.

The Department of Livestock, with help from the agencies, would maintain a boundary at Little Trail Creek/Maiden Basin hydrologic divide similar to alternative 1. Bison on private land moving north of this boundary would be removed by agency personnel with the permission of the landowner.

No capture would occur in the West Yellowstone area in either phase 1 or phase 2, but bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. As in alternatives 1 and 4, agencies would also maintain a boundary at the northern end of the Cabin Creek Recreation Area/Monument Mountain Unit of the Lee Metcalf Wilderness. Hunting would be used in both the Eagle Creek/Bear Creek and western SMAs to help control population numbers and distribution. Research on the degree to which the winter grooming of park roads contributes to migration out of the park may continue, and changes in road grooming practices made in phase 2 if research showed they were warranted. These changes would be implemented through amendments to the park's winter use plan and appropriate NEPA documentation.

Alternative 3 calls for acquisition of bison winter range through purchase of grazing rights, easements, or property from willing sellers, modifications in cattle allotments, and/or changes in livestock operations to remove susceptible cattle in phase 2. This newly acquired winter range would be designated an SMA (referred to as the Reese Creek SMA throughout the remainder of the description of alternative 3), and would include lands on the west side of the Yellowstone River between Reese Creek and Yankee Jim Canyon. If appropriate, the park's capture facility at Stephens Creek would be dismantled and relocated between the park boundary and Yankee Jim Canyon at a suitable site. The Department of Livestock, with help from the agencies, would maintain a boundary at Yankee Jim Canyon, and hunting in the Reese Creek SMA would be used to control population size and distribution of the bison herd.

If this alternative was selected, the agencies would request the 1999 Montana Legislature to authorize a fair-chase hunt for bison. Public hunting would then become the primary tool for agencies to maintain population sizes in the new Reese Creek SMA as well as the western SMA.

Modifications in grazing allotments in the West Yellowstone area would be an option in this alternative, which could mean bison would be allowed to occupy public lands year-round. The area over which bison would eventually be able to range (e.g., the SMAs) is shown on the Alternative 3 map.

NORTHERN BOUNDARY

Reese Creek

The National Park Service would continue to operate the capture facility at Stephens Creek inside Yellowstone National Park at the Reese Creek boundary in phase 1 of this alternative. Features of the facility are described in alternative 1, and no changes in the Stephens Creek operation except the additional shipping of seronegative bison to quarantine would be anticipated.

Bison evading capture inside the park may be shot by park or other agency personnel with permission from the National Park Service. Those crossing the Reese Creek border and unresponsive to hazing would be shot by the Department of Livestock with help from other agencies, and with permission of the landowner. Currently, efforts would be made to keep all bison from crossing onto private land, and only those unresponsive to hazing and crossing the

Reese Creek boundary would be shot. When a quarantine facility was constructed, some or all seronegative bison that would be captured could be quarantined.

Captured bison would be divided into groups for safety reasons, and blood tested for exposure to *B. abortus*. Seropositive bison would be shipped to slaughter at approved slaughter facilities. If a safe and effective vaccine was available, seronegative bison would be vaccinated. If population numbers were high or winter conditions were harsh, seronegative bison would be shipped to quarantine. If numbers were low, seronegative bison may be held and released when the weather moderated. Under normal circumstances, bison would not remain at the Stephens Creek facility longer than 24 hours. However, if the quarantine facility was not built or room was not available, if population numbers were low, or if winters were harsh, the agencies estimate between 100 and 125 bison could be safely held in the Stephens Creek capture facility.

In phase 2 of this alternative, agencies would dismantle the Stephens Creek capture facility and would not maintain any boundary control at the northern border of Yellowstone National Park. Bison could be hunted in the expanded SMA outside the park. Bison movements would be monitored from November 1 to April 30, but bison would not be hazed unless they approached Yankee Jim Canyon, a narrowing of the valley on national forest land about 12 miles north of Reese Creek. The majority of land north of this point in the valley bottom is privately owned, and agencies would enforce a boundary to keep bison from migrating beyond it. The capture facility would be relocated to a suitable area north of the park and south of Yankee Jim Canyon to provide agencies an option of shooting bison crossing the boundary and to help regulate population numbers.

Eagle Creek/Bear Creek

Agencies would monitor bison movements in the Eagle Creek/Bear Creek area and maintain a boundary at the Little Trail Creek/Maiden Basin hydrographic divide through hunting, hazing, and shooting.

WESTERN BOUNDARY

Agencies would monitor and shoot bison leaving the West Yellowstone area north of Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness. Those leaving to the west along Hebgen Lake Dam, or south on private property, would also be hazed or shot (see Alternative 3 map). Public hunting would be allowed in the western SMA on appropriate public lands and on private lands if landowners were willing. Existing capture facilities in the Duck Creek and Madison River area would be dismantled, as this alternative would not include capture or slaughter in the western SMA.

Bison would be hazed by agencies to move them from private to public land. Bison would also be hazed to remove them from the West Yellowstone area in May so cattle can occupy existing allotments in summer. Longer term modifications in allotments would also be possible in alternative 3, although hunting might reduce bison numbers in West Yellowstone to where they would provide no particular advantage to bison.

SPECIAL MANAGEMENT AREAS

In alternative 3, SMAs in phase 1 would be established in the Eagle Creek/Bear Creek area; the Absaroka-Beartooth Wilderness, including the Hellroaring and Slough Creek drainages; and the western boundary area south of Buffalo Horn Creek, including the Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness and West Yellowstone area (see Alternative 3 map). When either acquisitions were completed or modifications in cattle operations to remove susceptible cattle were accomplished, the Gardiner Valley west of the Yellowstone River from Reese Creek to Yankee Jim Canyon would also become an SMA (the Reese Creek SMA). The usable winter range


ALTERNATIVE THREE
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • May 1998 • 101 • 20,110
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
Stillwater County
Park County
Sweet Grass County
Madison County
Gallatin County
Gallatin County
Park County
to Livingston
Yankee Jim Canyon
Corwin Springs Bridge
Maiden Basin
Eagle Creek/
Bear Creek Area
BEAVERHEAD NATIONAL FOREST
BUFFALO HORN CREEK
LEE METCALF WILDERNESS
LEE METCALF WILDERNESS
Stephens Creek Area
REESE CREEK
Gardiner
YELLOWSTONE RIVER
HELLROARING CR.
MONTANA
WYOMING
Cooke City
Silver Gate
to Red Lodge
SHOSHONE NATIONAL FOREST
SLOUGH CREEK
Mammoth Hot Springs
Tower-Roosevelt
LAMAR RIVER
GALLATIN RIVER
Cabin Creek Recreation
& Wildlife Mgmt. Area
to Butte, Sheridan, and Dillon
Hebgen Dam
MADISON RIVER
YELLOWSTONE NATIONAL PARK
HEBGEN LAKE
Horse Butte Peninsula
DUCK CREEK
COUGAR CREEK
Canyon Village
Norris
Hayden Valley
BEAVERHEAD NATIONAL FOREST
West Yellowstone
Madison Junction
MADISON RIVER
GIBBON RIVER
FIREHOLE RIVER
MONTANA
IDAHO
MONTANA
WYOMING
TARGHEE NATIONAL FOREST
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
AREAS WHERE BISON MAY OCCUR OUTSIDE OF YELLOWSTONE NATIONAL PARK BOUNDARY
SPECIAL MANAGEMENT AREA
BISON HUNTING AREA
PHASE ONE
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
PHASE TWO
PHASE TWO (LONG TERM) SPECIAL MANAGEMENT AREA
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
POSSIBLE PHASE TWO BISON HUNTING AREA
MILES
0
5
10
NORTH

available to bison without agency management in this alternative would be similar to but less than alternative 2.

Winter hunting would be a primary population management tool in the Eagle Creek/Bear Creek SMA, the newly created Reese Creek SMA, and the western SMA (including Cabin Creek/Lee Metcalf). The hunt would likely be conducted periodically between October 1 and February 28 as bison move into the SMAs. Any capture operations, should they be needed, would occur during the remainder of the winter following the hunt, e.g., from March 1 to April 30.

In the West Yellowstone area cattle would be grazed during the summer months and bison hazed back into the park during May as long as required. Bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Hunting would help control population numbers and distribution in this SMA. In phase 2, if modifications in grazing allotments and other acquisitions and incentives allowed it, bison could remain year-round on public lands in the West Yellowstone area, although most would be probably be killed through hunting or would return inside park boundaries during the summer.

RISK MANAGEMENT

Strategies to ensure separation of cattle and bison explained above would be the primary means to manage the risk of transmission. These include temporal separation, capture, test, slaughter, and shooting in phase 1, and changes in existing cattle operations and boundary control measures in phase 2. Hunting in all SMAs would reduce the number of bison and the chances of bison migrating toward the boundaries maintained at Yankee Jim Canyon and Buffalo Horn Creek, and therefore the risk of transmission through contact with cattle grazed to the north of these areas.

In phase 1 of this alternative, the separation of cattle and bison at the northern border would be maintained by restricting bison at Reese Creek and Little Trail Creek/Maiden Basin hydrographic divide. At Reese Creek, this would include monitoring, hazing, capture and slaughter, and shooting as described above under the "Northern Boundary." At Eagle Creek/Bear Creek, monitoring, hazing and shooting would be used to prevent entry into the Gardiner area. Hunting would reduce the number of bison overall, hence the number migrating toward the Little Trail Creek/Maiden Basin hydrographic divide boundary.

In the western SMA, separation would be maintained through temporal means on public lands in the short term. Bison in the West Yellowstone area would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Bison would not be allowed back into the SMA until cattle have been removed in October. Topography, availability of habitat, hazing, hunting, and shooting would also keep bison from moving beyond SMA boundaries.

In phase 2, the primary means of separation on both the northern, newly created Reese Creek SMA, and the western SMA would shift to modifications in livestock operations or acquisition of property, easements, or other rights of use. On private land in the SMAs, which now is used for cattle grazing or other livestock operations, agencies might offer incentives to change operations so susceptible cattle were removed. Also, acquisition of private grazing rights, easements, or outright purchase of property from willing sellers might be used to remove cattle altogether on private property in the designated SMAs. In the western SMA, hunting would be expected to reduce the number of bison substantially, although modifications in grazing allotments might allow them to remain year-round. Until such changes were made, bison remaining after the winter hunt would be hazed into the park in May to ensure cattle

occupying the allotments during the summer did not commingle with bison.

Agencies would continue to maintain boundaries between public and private land at Yankee Jim Canyon on the north, and Buffalo Horn Creek to the west to ensure separation of bison and cattle in phase 2. Also, hunting in all SMAs would reduce the number of bison migrating toward these boundaries.

Vaccination of cattle calves in the western SMA on public lands would reduce risk of transmission. State animal health authorities would encourage livestock owners in the western SMA whose cattle might come in contact with bison to vaccinate female calves (4–12 months old) against brucellosis with RB51 or other approved vaccine. Operators in boundary areas would be encouraged to annually vaccinate all subadult cattle as well as calves. Cattle herds in contact areas would continue to be surveillance tested periodically, and any herd whose member (or members) was in contact with bison would be checked for exposure to *B. abortus*. Livestock owners on private property would continue to be responsible for all costs and materials associated with calfhood vaccination.

When a safe and effective vaccine was developed for bison, it would be administered to bison captured at the northern boundary capture facility, held at the quarantine facility, and/or through remote means to bison inside Yellowstone National Park.

POPULATION MANAGEMENT

Bison population numbers at the northern park boundary would be controlled through capture and quarantine or slaughter in phase 1, and hunting, capture, and quarantine in phase 2. Hunting would also be used to control numbers in phases 1 and 2 in the Eagle Creek/Bear Creek SMA and West Yellowstone area of the western SMA.

Quarantine

A quarantine facility would operate intermittently to give agencies flexibility in handling captured bison that they do not now have (see Alternative 3 map). It would also provide a source of live, disease-free bison for tribal governments and requesting organizations that would not be returned to the park. Current regulations do not permit removal of any part of the Yellowstone bison herd for quarantine and eventual release to interstate movement. Accordingly, APHIS, in cooperation with state livestock regulatory authorities, is developing a proposed change to 9 CFR 78 that would allow quarantine and eventual release of seronegative bison completing quarantine for interstate movement (see appendix B). Seronegative bison could be shipped to the quarantine facility and complete an approved quarantine protocol to ensure they were disease free, rather than slaughtered as they are now. Each animal initially assigned to a quarantine facility would have tested seronegative. When the bison have completed the procedure, they would be released live to requesting organizations or agencies.

If bison were migrating out of the park (or Reese Creek SMA in phase 2), and movements were large, making hunting infeasible, they would be captured. Seropositives would be sent to slaughter, and seronegatives would be quarantined and available for eventual release. If a winter was unusually severe and the herd size was low, some bison might be held through the winter and returned to the park.

At a minimum, all bison must have three consecutive negative serological tests, with at least 12 months between the first and last tests to complete quarantine protocol. To minimize the effect of finding reactors (seropositives), bison would likely be kept in several separated groups rather than one large group. Any bison showing signs of exposure to *B. abortus* during this quarantine period would be slaughtered, and testing of the remaining bison in contact with it begun again. Because of this, bison may need to remain in quarantine for several years to be declared disease-free. Bison successfully

completing the full quarantine procedure without contact with any infected animals would be available for release. Concurrent with testing, bison in quarantine could be vaccinated.

Quarantine facilities could be constructed on Gallatin National Forest in the vicinity of Gardiner, other public lands in the vicinity of Yellowstone National Park, lands elsewhere in Montana that would be leased or purchased for this purpose, or on the lands of a cooperating tribe or other organization. Possible designs and costs for a quarantine facility vary widely from a small feedlot-type approach to multiple pasture operation. Because a quarantine facility must ensure potentially diseased animals are not released, they include precautions such as double or triple fencing. Costs range from $500,000 to $800,000 and more to construct such a secure facility. If alternative 3 was selected, the agencies would sign a memorandum of understanding to formalize commitments regarding the quarantine facility.

A quarantine facility can only be operated in a class-free state if (1) APHIS allows the bison to be moved to the facility and (2) the state animal health authorities of that state permit the operation of a quarantine facility and allow the bison to be imported into the state. Also, evaluation of alternative locations and designs could be subject to additional compliance requirements, including criteria described in the "Actions Common to all Alternatives" section and NEPA analysis. For purposes of analysis, this environmental impact statement assumed all needed approvals were received and the quarantine facility was sited, built, and available in 1999 or within one year of the decision to select any alternative that included quarantine as a management tool (alternatives 3, 4, and 7).

Public Hunting

Upon issuance of the records of decision for the environmental impact statements, the agencies would request the 1999 Montana Legislature to authorize Montana to establish regulations for the public hunting of bison. Any public hunting program would be coordinated with the Department of Livestock and the state veterinarian in identifying acceptable animals and areas. In addition to controlling bison numbers, hunting would also help prevent bison on public lands in the Eagle Creek/Bear Creek area, bison on acquired winter range in the Reese Creek area (Reese Creek SMA) and in the western SMA from migrating to private lands, and help maintain bison population numbers and distribution.

This alternative envisions a fair-chase hunt to the extent possible. This would be in contrast to the hunts of the late 1980s, which were widely criticized as unfair to bison and unsporting. Features of a fair-chase hunt would include training or orientation to ensure accurate marksmanship, knowledge of and respect for bison, and emphasizing that all meat, as well as the hide and heads should be used. Hunters would be "on their own" and not accompanied by agency personnel as they were in the 1980s hunts. Hunters would be given no unfair mechanical advantage. Only a few permits would be issued for any given hunting period. Permit numbers would vary, depending on population size and the season format approved by the Montana Fish, Wildlife and Parks Commission. Bison might be hunted in more rugged and remote terrain in the neighboring Gallatin National Forest (Eagle Creek/Bear Creek).

It is not possible to completely describe how the bison season would be administered because Montana statutes do not currently authorize bison hunting. The analysis in this environmental impact statement assumed an application and selection process similar to procedures used to issue permits and licenses for other big game species.

The state's Department of Fish, Wildlife and Parks, in consultation with all cooperating agencies, would prepare recommendations for season length and format, permit quotas, and special regulations for the bison season. The department's recommendations would be developed to be consistent with the purpose of this alternative and in response to current

population levels, anticipated migrations, and current bison management issues. The Montana Fish, Wildlife and Parks Commission would approve these recommendations, with or without amendments, as tentative regulations. Upon approval, the commission would provide notice of publication and request public comment on the tentative regulations. Thereafter, the commission could adopt as final, amend, or disapprove the tentative regulations. Upon final approval, the general bison hunting regulations would be in effect for two years, except that permit quotas could change annually.

Each licensed hunter would be authorized to hunt bison only during the time period and only in the area designated on the person's license. The hunting license would not provide the assurance that bison would actually occupy the specified area during the designated hunting period. License fees would not be refunded to licensed hunters who chose not to hunt, nor would fees be refunded because bison were not available during the designated hunting period.

Hunting regulations would be strictly enforced. Hunters would be notified of the health risks and appropriate precautions for handling dead bison. Hunters would be required to attend a bison hunting orientation program prior to hunting. Successful hunters would be required to properly dispose of the offal and to report their kill to a designated official. Blood and tissue samples could be collected from hunter-killed bison. Prior to implementing the bison season, the cooperating agencies would negotiate agreements with affected landowners to provide private land access for bison hunting where possible. Licensed hunters would not be otherwise restricted or assisted by agency personnel. Hunting is assumed to begin in the year 2000. The analysis assumed that initial quotas would provide for a minimum of 10 permits in the Eagle Creek/Bear Creek area and that bulls would likely be harvested in this area. Twenty permits would be offered in the Reese Creek area. Bulls and larger females would likely be harvested in this area. Due to projected increasing bison numbers moving into the Reese Creek area, 25 permits could be offered beginning in 2005. Thirty permits would be offered in the West Yellowstone area, and nearly all bison, except possibly calves, would be harvested. Based on bison population numbers, winter distribution on public and private lands, and other factors, the agencies may hold additional special drawings to harvest additional bison.

Research on the degree to which winter road grooming inside the park contributes to migration outside the park (i.e., bison distribution) would be initiated if this alternative was selected. If the research showed bison use these roads, segments could be left ungroomed to keep more bison inside the park boundaries (see description of alternative 2 for more information).

ESTIMATE OF COST

Table 4 indicates the costs that would be incurred by the interagency team for alternative 3.

Table 4: Annual Cost/Income Estimates – Alternative 3

	National Park Service	U.S. Forest Service	State of Montana	APHIS	Shared Costs
Test/sample				$25,000	
Capture facility (Stephens Creek)[1]	$120,000				
Operations (capture, hunting, and bison management)	158,000	$25,000	$225,000		
Vaccination	150,000			8,000	
Relocate capture facility[1]	60,000				
Quarantine facility[1]				500,000 – 800,000[2]	
Quarantine operations (50/yr)				400,000	
Acquisition[1]					$33.1 million
Easement[1]					Unknown[3]
Conversion of livestock operations[1]					Unknown[3]
Allotment modification[1]		15,000			
TOTALS	($488,000)	($40,000)	($225,000)	($933,000 – $1,233,000)	(Up to $33.1 million)

1. One time only capital costs (costs for Stephens Creek facility have already been incurred).
2. Does not include land costs for quarantine facility.
3. Easement and conversion would substitute for acquisition, and costs would be less than $33.1 million.

ALTERNATIVE 4: INTERIM PLAN WITH LIMITED PUBLIC HUNTING AND QUARANTINE

The interim plan (no action, or alternative 1 in this analysis) has served to ensure spatial separation of the bison herd from domestic cattle on the north and west borders of Yellowstone National Park. However, it has given agencies few options when population numbers are high, and/or when harsh winters force more than the average number of bison toward the boundaries of Yellowstone National Park. The capture facility at Stephens Creek on the northern boundary was not designed to hold bison for more than a day or so; yet, because the 1996–97 winter was severe and unprecedented numbers of bison were being removed by management actions, the facility was used to keep more than 100 bison throughout the winter. For this reason, alternative 4 includes a quarantine facility to keep seronegative bison captured at Stephens Creek. Removal of bison to quarantine would also help keep population numbers from growing too large, as bison completing the quarantine protocol would be released to tribes, requesting organizations, or to repopulate herds on public lands. The location of the facility has not been determined, and would require subsequent MEPA/NEPA analysis, including public input, before any decision is made. The details of a quarantine facility are described in alternative 3.

Hunting is also a tool proposed for alternative 4 to help control population sizes and distribution. Except for these differences, alternative 4 is identical to the interim plan, alternative 1.

Vaccination of bison, which is part of all the alternatives, requires a safe and effective vaccine, yet one does not currently exist. Alternative 4 also assumes a quarantine facility would be available and hunting would be approved. A quarantine facility located on public land would require environmental review and compliance, and hunting could not take place unless the 1999 Montana Legislature approves it. This environmental impact statement assumes for purposes of analysis certain dates by which each of these events would occur. Any regulation changes needed to allow bison into SMAs outside the park are assumed to take place immediately upon signing the records of decision to select an alternative. Both the quarantine facility and hunting are assumed to be available by 2000. The provisions of the interim plan would continue until these features were in place. If the dates were not met, analysis in the "Environmental Consequences" part of this document for alternative 4 would be as described in alternative 1, the no-action alternative 1.

NORTHERN BOUNDARY

Reese Creek

The NPS capture facility located at Stephens Creek inside Yellowstone National Park at the Reese Creek boundary would continue to operate. Features of the facility are described in alternative 1, and no changes in the Stephens Creek operation except the additional shipping of seronegative bison to quarantine would be anticipated. Bison not captured and crossing the property would be hazed back into the park, or shot with permission of the landowners, as they are now. All captured bison would be tested for exposure to *B. abortus*. Bison evading capture inside the park or unresponsive to hazing would be shot on private land. When the quarantine option was available, some bison would be quarantined.

Captured bison would be divided into groups for safety reasons, and blood tested for exposure to *B. abortus*. Seropositive bison would continue to be shipped to slaughter at approved slaughter facilities. If a safe and effective vaccine was available, seronegative bison would be vaccinated. If population numbers were high or winter conditions were harsh, seronegative bison (including pregnant females) would be shipped to quarantine. If numbers were low, seronegative

bison could be held until weather moderated and released for return to the park's interior. Under normal circumstances, bison would not remain at the Stephens Creek facility for longer than 24 hours. However, if the quarantine facility was not yet built or room was not available and population numbers were low, it could be used to keep some bison through the winter. The agencies estimate between 100 and 125 bison could be safely held in the Stephens Creek capture facility.

Eagle Creek/Bear Creek

Agencies would continue to monitor bison movements in the Eagle Creek/Bear Creek area and maintain a boundary at the Little Trail Creek/Maiden Basin hydrographic divide from November to April. However, if the Montana Legislature approved it, a fair-chase hunt from approximately October 1 to February 28 would be the primary tool used to control population numbers in this area. Details of the hunt are described in alternative 3. Fewer bison would likely attempt to cross over into the Little Trail Creek/Maiden Basin area if hunting reduced their numbers.

WESTERN BOUNDARY

Entry into the western boundary area would continue to be controlled using capture facilities (now located at Duck Creek and along the Madison River) from November 1 to April 30. Facilities might be moved to take advantage of changing bison migration routes from year to year. Bison evading capture at these facilities on public lands would be shot. Those evading capture on private lands would be shot at the request or with permission of the landowner. Bison on both private and public land in the area of each of these facilities might respond to baiting or hazing and be captured by agency personnel. Captured bison would be blood tested for exposure to *B. abortus.* All seropositive bison would be shipped to slaughter. Seronegative-nonpregnant females and all seronegative males would be identified with a small metal ear tag and a temporary visual marker, and released on public lands in the West Yellowstone area, where they could remain until May. If necessary, bison might need to be shipped a short distance from the capture facility to public lands. Seronegative-pregnant bison would be shipped to quarantine, where they would follow the quarantine protocol. Following successful completion of the quarantine protocol (see quarantine description in alternative 3), bison would be released to requesting tribes and organizations or used to repopulate herds on public lands. Limited hunting in the western boundary area, primarily as a recreational opportunity rather than as a population management tool, is also a part of this alternative.

SPECIAL MANAGEMENT AREAS

In this alternative, SMAs would be established in the Eagle Creek/Bear Creek area; the Absaroka-Beartooth Wilderness, including the Hellroaring and Slough Creek drainages; and the western boundary area south of Buffalo Horn Creek, including the Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness and the West Yellowstone area (see Alternative 4 map).

Cattle would continue to be grazed in the West Yellowstone area on Gallatin National Forest lands from about June 15 to October 15. Cattle graze on private land from approximately June 1 to November 15. Bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Bison would be allowed back into the West Yellowstone area following the departure of livestock. Bison would be shot by agencies if they occupied private lands in the area (by request or with permission of the landowner), or left the SMAs. Because there is very high elevation country to the west and private lands to the south, bison would only be able to leave the West Yellowstone area on public lands via a

narrow corridor around Hebgen Lake Dam. Those that did so would be shot.

Bison would be able to occupy the Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness to the north of the West Yellowstone area without interference from the agencies. These are public lands free of cattle, although topography and snow depths limit the number of bison that actually use them. Hunting from October 1 to February 28 would be allowed in both the Eagle Creek/Bear Creek SMA and West Yellowstone area of the western SMA. It would be the primary means of controlling population numbers in the Eagle Creek/Bear Creek area, and be used mostly for recreational purposes in West Yellowstone, although some secondary population control benefits would be expected.

RISK MANAGEMENT

Alternative 4 would rely on separation, capture, and slaughter to minimize the risk of brucellosis transmission.

The primary means to ensure separation of cattle and bison would be the enforcement of controlled entry at the northern border described above, and temporal separation at the western border on public lands. At Reese Creek, this would include monitoring, hazing, capture and slaughter, quarantine, and shooting. At Eagle Creek/Bear Creek, monitoring, hazing, hunting and agency shooting would be used to prevent entry into the Gardiner area.

In the western SMA, bison would be hazed back into the park from the West Yellowstone area to prevent them from mingling with cattle during the time livestock were present. Any remaining bison would be shot. Hunting would reduce the number of bison and slightly reduce pressure of migrating bison on boundary areas. As described above, bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Bison would not be allowed into the SMA until cattle have been removed in October. Topography, availability of habitat, hazing, and agency shooting would also keep bison from moving beyond SMA boundaries or onto private land.

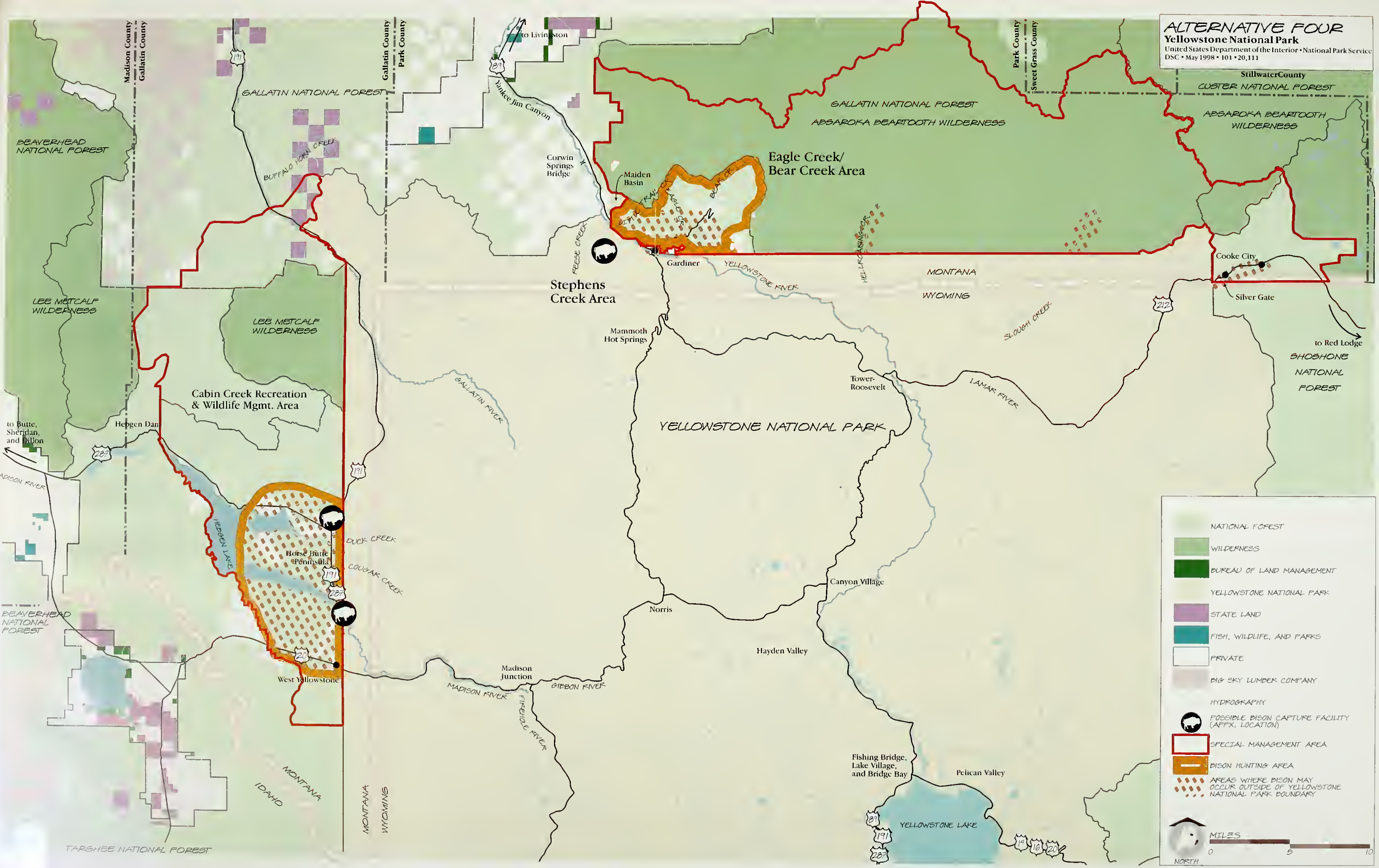
In addition to separation, this alternative would reduce risk of transmission through capture and slaughter, and quarantine (see below for more information on quarantine). All seronegative bison captured in the Stephens Creek facility and seronegative-pregnant bison in the western SMA would be quarantined, and all seropositives would be slaughtered. This would remove all possible reactors from the vicinity where cattle would eventually be. Removing pregnant bison would ensure their birth materials did not remain onsite when cattle returned to the allotments.

State animal health authorities would encourage livestock owners in the western SMA whose cattle might come in contact with bison to vaccinate female calves (4–12 months old) with RB51. Operators in boundary areas would be encouraged to annually vaccinate all subadult cattle as well as calves. Cattle herds in contact areas would continue to be surveillance tested periodically, and any herd whose member or members might be in contact with bison would be checked for exposure to *B. abortus*. Livestock owners on private property would continue to be responsible for all costs and materials associated with calfhood vaccination.

When a safe and effective vaccine was developed for bison, it would be administered to bison in capture facilities testing negative. It might also be delivered through remote means to bison inside Yellowstone National Park.

POPULATION MANAGEMENT

Bison population numbers at the Reese Creek boundary would be controlled through quarantine or slaughter. In the West Yellowstone area, slaughter, quarantine, and to a lesser extent, hunting would be used to control population numbers. Hunting would be the primary means


ALTERNATIVE FOUR
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • May 1998 • 101 • 20,111
Eagle Creek/ Bear Creek Area
Stephens Creek Area
Cabin Creek Recreation & Wildlife Mgmt. Area
YELLOWSTONE NATIONAL PARK
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
LEE METCALF WILDERNESS
SHOSHONE NATIONAL FOREST
TARGHEE NATIONAL FOREST
Madison County
Gallatin County
Park County
Sweet Grass County
Stillwater County
MONTANA
WYOMING
IDAHO
Gardiner
Cooke City
Silver Gate
Mammoth Hot Springs
Tower-Roosevelt
Canyon Village
Norris
Madison Junction
West Yellowstone
Hayden Valley
Pelican Valley
Fishing Bridge, Lake Village, and Bridge Bay
Corwin Springs Bridge
Maiden Basin
Horse Butte Peninsula
Hebgen Dam
to Butte, Sheridan, and Dillon
to Livingston
to Red Lodge
Yankee Jim Canyon
YELLOWSTONE LAKE
HEBGEN LAKE
YELLOWSTONE RIVER
LAMAR RIVER
GALLATIN RIVER
MADISON RIVER
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FIREHOLE RIVER
SLOUGH CREEK
DUCK CREEK
COUGAR CREEK
BUFFALO HORN CREEK
REESE CREEK
BEAR CR.
HELLROARING CR.
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
SPECIAL MANAGEMENT AREA
BISON HUNTING AREA
AREAS WHERE BISON MAY OCCUR OUTSIDE OF YELLOWSTONE NATIONAL PARK BOUNDARY
MILES
0 5 10
NORTH

of controlling numbers in the Eagle Creek/Bear Creek SMA.

Quarantine

A quarantine facility would give agencies flexibility in handling captured bison that they did not have (see "Alternative 3"). It would also provide a source of live, disease-free bison for tribal governments, requesting organizations, or to establish populations on other public lands. Seronegative bison could be shipped to the quarantine facility and complete an approved protocol to ensure they were disease free, rather than slaughtered as they are now. When they have completed the quarantine procedure, they would be released live to requesting organizations or agencies (see appendix B for quarantine protocol). If population numbers in the Yellowstone herd were high and bison were migrating out of the park, more seronegative bison captured on the west side might be quarantined, rather than released into the SMA. If numbers were low and unusually severe weather caused migration out of the park, seronegative bison might be held through the winter at the capture facilities and returned to the park rather than quarantined. Quarantined bison would be available for release to requesting tribes, organizations, or to repopulate herds on public lands, but would not be returned to the park. Any bison showing signs of exposure to *B. abortus* during the quarantine period would be slaughtered, and testing of the remaining bison in contact with it begun again. Because of this, bison might need to remain in quarantine for several years to be declared disease free. Bison successfully completing the full quarantine procedure without contact with any infected animals would be available for release. (See "Quarantine" section in alternative 3 for more information on facility descriptions and procedures.)

Public Hunting

Procedures for administering a bison hunting season would be similar to that described for alternative 3. Upon issuance of the records of decision, the agencies would request the Montana Legislature to authorize Montana to establish regulations for the public hunting of bison. If approved, regulated public hunting seasons would be administered primarily for the purpose of providing recreational hunting; to control bison numbers on public lands in the Eagle Creek/Bear Creek area; and, as a secondary method to control bison numbers in the West Yellowstone areas.

ESTIMATE OF COST

Table 5 indicates the costs that would be incurred by the interagency team for alternative 4.

TABLE 5: ANNUAL COST/INCOME ESTIMATES – ALTERNATIVE 4

	National Park Service	U.S. Forest Service	State of Montana	APHIS
Test/sample				$20,000
Capture facilities[1]	$120,000		$175,000	50,000
Operations (capture, hunting, and bison management)	158,000	$25,000	275,000	100,000
Quarantine facility[1]				500,000 – 800,000[2]
Quarantine operations				400,000
Vaccination	150,000			8,000
Average income from the sale from meat, hides, and heads			+42,000	
TOTAL	($428,000)	($25,000)	($408,000)	($1,078,00 – $1,378,000)

1. One time only (costs for existing facilities at Stephens Creek and western SMA have already been incurred).
2. Does not include costs for land acquisition.

ALTERNATIVE 5: AGGRESSIVE BRUCELLOSIS CONTROL WITHIN YELLOWSTONE NATIONAL PARK THROUGH CAPTURE, TEST, AND REMOVAL

This alternative would implement an aggressive three-year capture and test program for all bison in the park, including those in its interior. Those testing negative would be released in the park, and seropositives would be shipped to slaughter. If a safe and effective vaccine was available, seronegative bison would also be vaccinated. Bison would not be allowed outside the park anywhere in Montana (see Alternative 5 map), and agencies would maintain northern and western boundaries. Bison at these boundaries would be hazed back into the park if possible, but shot if they were unresponsive to hazing and leave the park. Capture facilities at Stephens Creek and at the western boundary area would be retained. In addition, an estimated seven temporary capture facilities would be set up in interior areas of the park. All untested bison would be shot in the latter stages of the capture, test, and slaughter program.

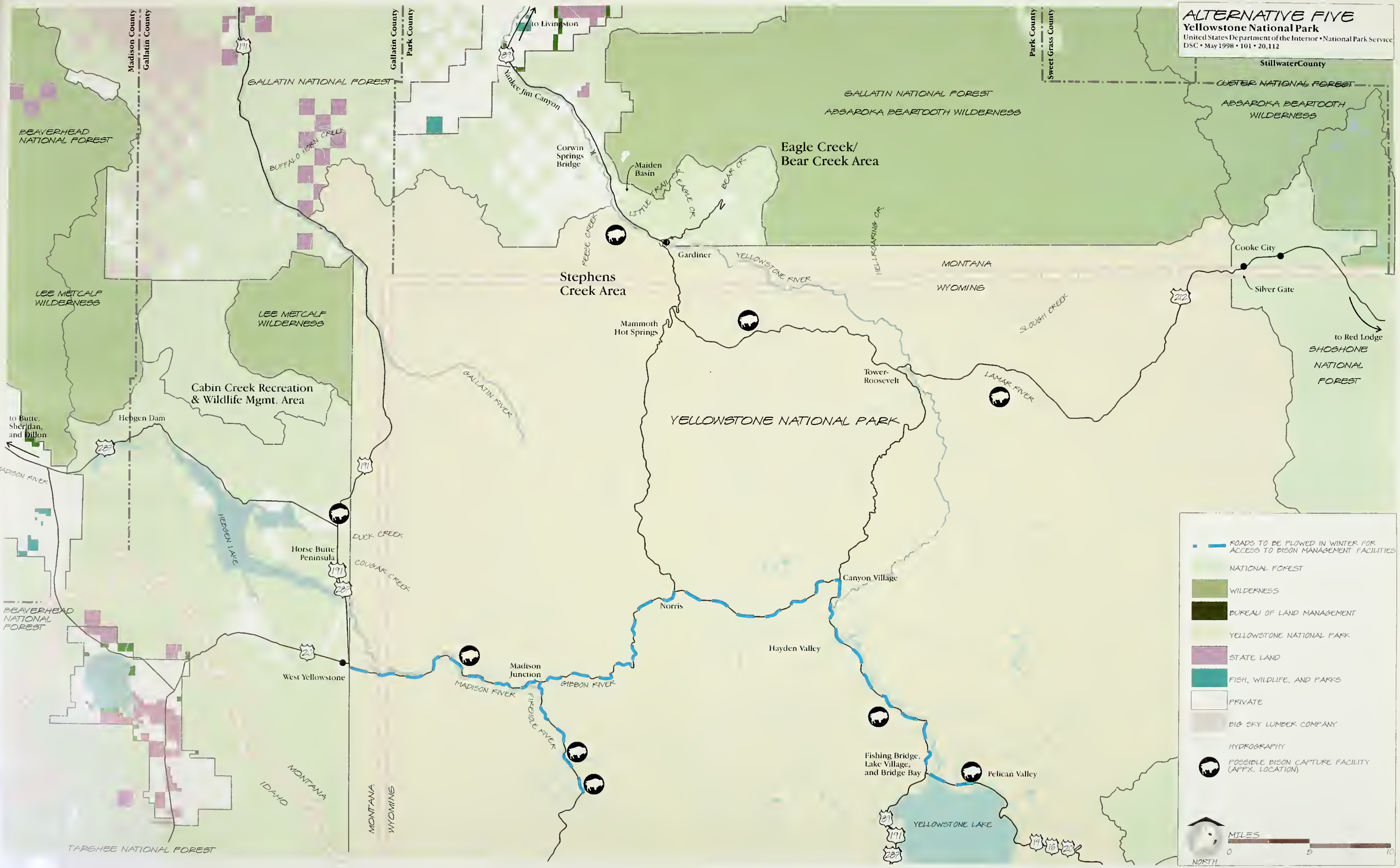
After all park bison have been tested or removed, the herd would be monitored for re-appearance of brucellosis. After a number of years, the entire herd would be captured and retested. Some or all of the capture facilities would be retained for this purpose. If sero-positive bison were found, they would be sent to slaughter and the herd monitored and retested again after a period of time. If the entire herd tested free of brucellosis (i.e., less than .1% seropositive for five years), the agencies would devise a new long-term bison management plan recognizing the herd as brucellosis free. For this reason, management under alternative 5, should it be selected, might not extend the full 15 years assumed for other alternatives.

Fewer unknowns exist for this alternative than most of the other alternatives. Quarantine, SMAs, or land acquisition are not part of alternative 5. Although a safe and effective vaccine for bison is not yet available, implementation of this alternative does not depend on such a vaccine, but would only use it as a follow-up to parkwide capture and slaughter of seropositive bison. Each of the capture facilities would require environmental clearance to prevent impacts on natural or cultural resources, in particular threatened or endangered species or archeological resources. However, the agencies believe the areas where capture facilities would be needed are broadly defined enough that a suitable location within each (where these resources would not be affected) could be identified.

NORTHERN BOUNDARY

Reese Creek

Although the NPS capture facility located at Stephens Creek inside Yellowstone National Park at the Reese Creek boundary would continue to operate, boundaries would primarily be controlled through monitoring of bison movements (see "Actions Common to All Alternatives"), hazing to return them to the park, and shooting. The Stephens Creek facility and its operation is described in alternative 1. Agencies would monitor bison prior to and during capture operations to locate bison groups for capture. Monitoring to assist with capture would occur at least twice a month during the period in which capture operations are taking place. During winter as bison approached the northern boundary, agency personnel would record bison locations once per week. When bison approached the Reese Creek area, the northern boundary area east of Gardiner, and the West Yellowstone area, their movements would be monitored daily. Because numerous capture and slaughter operations would be located throughout the park, fewer bison would likely be available to migrate to Reese Creek or other boundary areas. Agency personnel could haze on foot or horseback, in vehicles or aircraft, and might use cracker shells, rubber bullets, or other techniques, or any combination of those methods



ALTERNATIVE FIVE
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • May 1998 • 101 • 20,112
Eagle Creek/
Bear Creek Area
Stephens
Creek Area
Cabin Creek Recreation
& Wildlife Mgmt. Area
YELLOWSTONE NATIONAL PARK
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
ABSAROKA BEARTOOTH
WILDERNESS
BEAVERHEAD
NATIONAL FOREST
LEE METCALF
WILDERNESS
LEE METCALF
WILDERNESS
SHOSHONE
NATIONAL
FOREST
TARGHEE NATIONAL FOREST
BEAVERHEAD
NATIONAL
FOREST
Madison County
Gallatin County
Gallatin County
Park County
Park County
Sweet Grass County
StillwaterCounty
to Livingston
Yankee Jim Canyon
Corwin
Springs
Bridge
Maiden
Basin
Gardiner
Mammoth
Hot Springs
Tower-
Roosevelt
Cooke City
Silver Gate
to Red Lodge
to Butte,
Sheridan,
and Dillon
Hebgen Dam
Horse Butte
Peninsula
West Yellowstone
Madison
Junction
Norris
Canyon Village
Hayden Valley
Fishing Bridge,
Lake Village,
and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
HEBGEN LAKE
MONTANA
WYOMING
MONTANA
WYOMING
MONTANA
IDAHO
BUFFALO HORN CREEK
LITTLE TRAIL CR.
EAGLE CR.
BEAR CR.
REESE CREEK
HELLROARING CR.
YELLOWSTONE RIVER
SLOUGH CREEK
LAMAR RIVER
GALLATIN RIVER
MADISON RIVER
DUCK CREEK
COUGAR CREEK
MADISON RIVER
GIBBON RIVER
FIREHOLE RIVER
191
89
212
287
191
287
20
89
191
287
14
16
20
ROADS TO BE PLOWED IN WINTER FOR ACCESS TO BISON MANAGEMENT FACILITIES
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
MILES
0
5
10
NORTH

to move bison back into the park or into the Stephens Creek capture facility. Those bison crossing the Reese Creek border and unresponsive to hazing would be shot on private land by agencies with permission of the landowner.

Eagle Creek/Bear Creek

Agencies would monitor bison movements in the Eagle Creek/Bear Creek area from November to April, and, unlike other alternatives, would shoot any bison in this area. The frequency of monitoring would be the same as in other alternatives, except bison would not usually be able to make it to the Little Trail Creek/Maiden Basin hydrographic divide without being detected and shot. Hazing would not normally be a viable option to return bison to the park, unless bison were near the park boundary.

WESTERN BOUNDARY

Bison would be monitored as they approached the western park boundary. They would be hazed to return them to the park, and shot or captured outside the park if unresponsive to hazing. Two Department of Livestock capture facilities located at Duck Creek and along the Madison River might be retained to aid in the brucellosis eradication effort and help enforce the western boundary.

SPECIAL MANAGEMENT AREAS

No SMAs would be created in this alternative, as bison would not be allowed outside park boundaries.

RISK MANAGEMENT

The primary means of managing the risk of transmission in this alternative would be the confinement of bison to park boundaries and the parkwide capture and slaughter of seropositive bison. The National Park Service would maintain temporary capture facilities and carry out capture and testing operations in some or all of the following locations inside Yellowstone National Park in an attempt to capture every bison inside the park (see Alternative 5 map):

- Stephens Creek (existing capture facility)
- Blacktail Plateau
- Lamar/Crystal Bench
- Pelican Valley
- Hayden Valley
- Firehole River/Old Faithful (two facilities)
- Madison River

Capture facilities in the western boundary area could also be retained.

The precise locations of these facilities is unknown. However, the criteria listed in the "Actions Common to All Alternatives" chapter would apply in siting the facilities.

Capture operations in the north and west boundary areas (Stephens Creek and West Yellowstone) would take place throughout winter, with interior park capture operations occurring during early to mid winter (November to January) when areas were accessible by wheeled vehicles. Park roads now left unplowed would be plowed to transport seropositive bison to slaughter (see Alternative 5 map). NPS personnel would shoot untagged bison in remote areas where capture operations would not be feasible during the latter stages when few seropositive bison remain in the herd. Agencies would monitor at least twice a month during the period when capture operations are taking place. If bison approached either the northern or western boundary area, their locations would be recorded weekly. As they approached the park boundary line, their movements would be monitored daily.

Captured bison would be divided into groups for safety reasons, and blood tested for exposure to *B. abortus*. Seropositive bison would continue to be shipped to slaughter at approved slaughter facilities. Therefore, temporary capture facilities would be located adjacent to existing roads. Seronegatives would be identified with a small

metal ear tag and a temporary visual marker, and released into Yellowstone National Park. Features of the capture facilities include separating pens, chutes, loading facilities, and areas to hold bison.

In addition to parkwide capture, test, and slaughter, risk would be managed by preventing bison from leaving the park. Because no cattle graze inside the park, cattle and bison would be completely spatially separated. Existing capture facilities at Reese Creek on the north, and at Duck Creek and the Madison River on the west, might be retained to provide agencies the option of capture to maintain these boundary controls. However, the primary means of controlling the exit of bison from the park would be shooting and hazing. Drops in population numbers associated with the capture and slaughter of all seropositive bison in the park would also act to reduce the number of bison migrating out of the park.

Operators in boundary areas would be encouraged to annually vaccinate all subadult cattle as well as calves. Cattle herds in contact areas would continue to be surveillance tested periodically, and any herd whose member or members might be in contact with bison would be checked for exposure. Livestock owners on private property would continue to be responsible for all costs and materials associated with calfhood vaccination.

When a safe and effective vaccine was developed for bison, it would be administered to seronegative bison in capture facilities. It might also be delivered through remote means to bison inside Yellowstone National Park.

POPULATION MANAGEMENT

The aggressive capture and slaughter program is likely to lower population numbers quickly, particularly if it was accomplished over a three-year span of time. If the herd approached the minimum viable size (estimated at 580 animals) needed to maintain genetic viability, capture and slaughter operations would be slowed or halted. When it was clear the population was not in danger of falling below this number, operations would begin again.

ESTIMATE OF COST

Table 6 indicates the costs that would be incurred by the interagency team for alternative 5.

TABLE 6: ANNUAL COST/INCOME ESTIMATES – ALTERNATIVE 5

	National Park Service	U.S. Forest Service	State of Montana	APHIS
Test/sample				$45,000
Vaccination during capture	$25,000			6,000
Vaccination during phase 2	150,000			
Capture facility (Stephens Creek)[1]	120,000			
Capture operations (continuing)	206,000	$15,000		
Other capture facilities (8)[1]	960,000			
Operation of other capture facilities (3 years) during test and slaughter	655,000			
Equipment/repair/replacement	200,000			
Road plowing (3 years)	250,000–350,000			
Average income during parkwide capture from the sale of meat, hides, and heads	+430,700			
TOTALS	($2,135,300 – $2,235,300)	($15,000)		($51,000)

1. One time only (costs for Stephens Creek facility have already been incurred).

ALTERNATIVE 6: AGGRESSIVE BRUCELLOSIS CONTROL WITHIN YELLOWSTONE NATIONAL PARK THROUGH VACCINATION

This alternative, like alternative 5, pursues the aggressive reduction of brucellosis from the Yellowstone bison herd. However, the entire bison herd would first be vaccinated (when a safe and effective vaccine was available), primarily through remote means, and tested as they attempted to exit at park boundary locations. When tests showed the incidence of exposure to *B. abortus* ceased to decline as a result of vaccination, the herdwide capture, test, and slaughter outlined in alternative 5 would begin. The vaccination stage of this alternative is referred to as phase 1; the capture, test, and slaughter as phase 2.

Unlike alternative 5, bison would be allowed in the Eagle Creek/Bear Creek and western SMAs (see Alternative 6 map), although the majority of bison in the western SMA would be tested and seronegatives released. The National Park Service would construct and operate a capture facility at Seven-Mile Bridge inside the park on the west side. Nearly all bison migrating toward the West Yellowstone area cross through this narrow area, giving agencies a better chance for capturing 100% of the bison than if existing Department of Livestock facilities at Duck Creek and Madison River were used. These facilities (at Duck Creek and Madison River) would be dismantled, although a small, backup capture facility near Horse Butte might be maintained.

Like alternatives 2, 3, 4, and 7, alternative 6 would include the creation of SMAs to allow bison outside the park. It also depends heavily on a safe and effective vaccine for bison for implementation. Both of these management tools involve some unknowns. For the purposes of this environmental impact statement, the agencies have assumed that any approvals needed to allow bison outside the park would be made immediately upon signing the records of decision to select an alternative, and that a vaccine that was safe and effective for bison, and safe for nontarget species, would be available by 2000. If these dates were not met, the impacts described in the "Environmental Consequences" of alternative 6 could be slightly different than indicated.

NORTHERN BOUNDARY

Reese Creek

The National Park Service would continue to operate the capture facility at Stephens Creek inside Yellowstone National Park to maintain boundary control at Reese Creek. Features of the facility are described in alternative 1, and no changes in the Stephens Creek operation would be anticipated under this alternative. Bison crossing the boundary would be hazed back into the park or shot. All captured bison would be tested for exposure to *B. abortus*. Bison evading capture inside the park might be shot. Those crossing the Reese Creek boundary and unresponsive to hazing would be shot on private land by agencies with permission of the landowner.

Captured bison would be divided into groups for safety reasons. All bison, whether seropositive or seronegative, would be shipped to slaughter at approved slaughter facilities. Under normal circumstances, bison would not remain at the Stephens Creek facility for longer than 24 hours.

When the aggressive capture and slaughter phase of this alternative began following the stabilization of seroprevalence in the population (predicted to occur after year 10 of vaccination), the Stephens Creek facility would become one of several capture facilities in the park, although boundary control at Reese Creek would likely be less problematic as population numbers would drop quickly. Monitoring, hazing, and shooting would remain as border control measures at Reese Creek.

Eagle Creek/Bear Creek

Agencies would monitor bison movements in the Eagle Creek/Bear Creek area and maintain a boundary at the Little Trail Creek/Maiden Basin hydrographic divide from November to April as described in alternatives 1, 3, and 4.

WESTERN BOUNDARY

During phase 1 and as needed during phase 2, entry into the western boundary area from November 1 to April 30 would be controlled with a new NPS capture facility located at Seven-Mile Bridge inside the western end of Yellowstone National Park, 7 miles from the western border of the park. Bison evading capture at this facility and exiting the park would be shot. Agencies would use hazing (as described above for the Stephens Creek facility), wing fences, and/or bait to move bison into the facility. Bison would be separated and blood tested for exposure to *B. abortus.* All sero-positive bison would be shipped to slaughter. The facility would occupy approximately 13 acres, with corrals for holding bison, and four pens to separate them. Two pastures would be available to hold bison for 24 to 36 hours until testing was completed. Water would be provided from the nearby Madison River. Electricity, if needed, would be provided by diesel generators. The facility would be located adjacent to a road, so seropositive bison could be shipped to slaughter. It would also be located so as to meet all additional criteria described in the "Actions Common to All Alternatives." The 7 miles of park road between the facility and West Yellowstone would be plowed to facilitate transport of seropositives to slaughter. When a safe and effective vaccine was available, sero-negative bison captured at this facility would be vaccinated.

Seronegative animals would be identified with a small metal ear tag and a temporary visual marker, and released onsite. They might continue their migration to the West Yellowstone area and occupy public lands outside the park in the West Yellowstone area (see Alternative 6 map), or remain inside the park. They can remain on public lands in the western SMA until May, when agencies would haze them back inside park boundaries. Bison would be shot by agencies if they occupied private lands in (by request or with permission of the landowner) or attempted to leave the SMA.

The Seven-Mile Bridge facility would continue to operate following the stabilization of sero-prevalence rates and progression to the aggressive capture and slaughter phase of this alternative. As population numbers dropped in the interior of the park, fewer bison would be likely to migrate toward the west end of the park and be captured in the Seven-Mile Bridge facility.

SPECIAL MANAGEMENT AREAS

In this alternative, SMAs would include the Eagle Creek/Bear Creek area, the Hellroaring and Slough Creek drainages, Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness, and the portion of West Yellowstone shown on the Alternative 6 map. Cattle would be grazed on Gallatin National Forest lands in the West Yellowstone area from about June 15 to October 15. During phase 1 and as needed during phase 2 of this alternative, bison in the West Yellowstone area would be hazed back into the park in the spring, 30–60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Bison that could not be hazed back into the park would be shot. They would be allowed back into the western SMA following the departure of livestock.

Bison could occupy the Eagle Creek/Bear Creek area year-round. They would also be allowed to occupy the Cabin Creek area, Lee Metcalf Wilderness, and Hellroaring and Slough Creek drainages without agency intervention.

ALTERNATIVE SIX
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • May 1998 • 101 • 20,113
Madison County
Gallatin County
Gallatin County
Park County
Park County
Sweet Grass County
Stillwater County
GALLATIN NATIONAL FOREST
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
BEAVERHEAD NATIONAL FOREST
LEE METCALF WILDERNESS
LEE METCALF WILDERNESS
BUFFALO HORN CREEK
to Livingston
Yankee Jim Canyon
Eagle Creek/
Bear Creek Area
Maiden Basin
BEAR CR.
REESE CREEK
Stephens
Creek Area
Gardiner
YELLOWSTONE RIVER
HELLROARING CR.
MONTANA
WYOMING
Cooke City
Silver Gate
to Red Lodge
SHOSHONE NATIONAL FOREST
SLOUGH CREEK
Mammoth
Hot Springs
Tower-
Roosevelt
LAMAR RIVER
GALLATIN RIVER
Cabin Creek Recreation
& Wildlife Mgmt. Area
Hebgen Dam
to Butte,
Sheridan,
and Dillon
MADISON RIVER
YELLOWSTONE NATIONAL PARK
HEBGEN LAKE
Horse Butte
Peninsula
DUCK CREEK
COUGAR CREEK
Only seronegative bison allowed on
public land in West Yellowstone
Canyon Village
Norris
BEAVERHEAD NATIONAL FOREST
7 Mile Bridge Facility
Madison
Junction
West Yellowstone
MADISON RIVER
GIBBON RIVER
FIREHOLE RIVER
Hayden Valley
Fishing Bridge,
Lake Village,
and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
MONTANA
IDAHO
MONTANA
WYOMING
TARGHEE NATIONAL FOREST
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
AREAS WHERE BISON MAY OCCUR OUTSIDE OF YELLOWSTONE NATIONAL PARK BOUNDARY
SPECIAL MANAGEMENT AREA
PHASE ONE
ROADS TO BE PLOWED IN WINTER FOR ACCESS TO BISON MANAGEMENT FACILITIES
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
PHASE TWO
ROADS TO BE PLOWED IN WINTER FOR ACCESS TO BISON MANAGEMENT FACILITIES
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
MILES
0
5
10
NORTH

RISK MANAGEMENT

Phase 1 of this alternative relies on vaccination of bison and spatial and temporal separation measures to minimize risk until seroprevalence rates stabilized. When they did (predicted to occur about 10 years after whole-herd vaccination begins), a phase 2 parkwide capture, test, and slaughter program would be implemented to reduce risk to near zero. Throughout both phases, spatial separation would be assured through the enforcement of controlled entry at the northern and western borders described above, as well as temporal separation at the western border on public lands. At Reese Creek, this would include monitoring, hazing, capture and slaughter, and shooting. At Eagle Creek/Bear Creek, monitoring, hazing, and shooting would be used to prevent entry into the Gardiner area. On the western end, the Seven-Mile Bridge capture facility would catch most bison migrating toward the West Yellowstone area, and monitoring, hazing, capture and slaughter, and shooting would be used to maintain this boundary and ensure separation of bison and cattle. Topography and availability of habitat also keep bison from straying beyond SMA boundaries.

In the West Yellowstone area of the western SMA, cattle and bison would also be separated in time. During phase 1 and as needed during phase 2 of this alternative, bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Bison would not be allowed into the SMA until cattle have been removed in October.

The capture facilities and boundary control measures would continue in phase 2 of this alternative, when aggressive capture and slaughter of all seropositive bison in the herd begins. However, since population numbers would drop quickly, fewer bison would migrate out of the park toward lands occupied by cattle.

In addition to the means described above to ensure boundary control and bison and cattle separation, this alternative would include aggressive vaccination of the entire park herd on an annual basis, and the capture and slaughter of all remaining seropositive bison. Vaccination with a safe and effective vaccine of captured seronegative bison would occur through hand injection during phase 2, as well as remote vaccination through means such as bio-bullets. Remote vaccination would occur yearly. While the vaccination effort is ongoing, the risk of transmission would be controlled by restricting bison to areas where cattle were not present (described above), or through temporal separation. Risks would be further reduced by slaughtering all captured seropositive bison.

When seroprevalence rates did not decrease for a period of two years, they would assume to have stabilized and phase 2 would begin. The National Park Service would then construct seven additional capture facilities across the park as described in alternative 5. Bison throughout the park would be captured, tested, and seropositives slaughtered. Roads inside the park indicated on the alternative 6 map would be plowed as needed to allow transport of seropositive bison to slaughter. Agencies would attempt to capture every bison in the park, and would shoot those not marked as seronegative in inaccessible areas. Capture operations inside the park would occur primarily during late fall and early winter.

Agencies would haze on foot, on horseback, or by helicopter to move bison toward capture facilities, using wing fences, bait, loud noise, or other methods. The combination of vaccination and capture and slaughter would eventually result in a very low rate of seroprevalence in the bison population, and reduce the risk of transmission to cattle to near zero. Vaccination of bison would continue following the capture and slaughter of seropositive bison to help ensure the lowest possible infection rate. The length of time vaccination of the herd continues would depend on the original efficacy of the vaccine, and the success of ongoing efforts to control brucellosis in the Wyoming elk population.

State animal health authorities would encourage livestock owners in the western SMA whose cattle may come in contact with bison to vaccinate female calves (4–12 months old) against brucellosis with RB51 or other approved vaccine. Operators in boundary areas would be encouraged to annually vaccinate all subadult cattle as well as calves. Cattle herds in contact areas would continue to be surveillance tested periodically, and any herd whose member or members may be in contact with bison would be checked for exposure. Livestock owners on private property would continue to be responsible for all costs and materials associated with calfhood vaccination.

POPULATION MANAGEMENT

The effect of capture and slaughter operations at Stephens Creek and Seven-Mile Bridge and other boundary control measures would be to reduce population numbers, particularly during harsh winters when many bison might attempt to move toward park boundaries. During phase 2 of this alternative when capture facilities were set up throughout the park, population numbers would be expected to move toward the lower, rather than higher, end of the range. If numbers moved toward the lower end of the range during phase 1 of this alternative, both capture facilities could be converted to temporary holding facilities to keep bison during harsh winters. If population numbers fell too quickly during the second parkwide capture and slaughter phase of this alternative, operations would be slowed or halted until the population numbers showed stabilization or recovery.

ESTIMATE OF COST

Table 7 indicates the costs that would be incurred by the interagency team for alternative 6.

Table 7: Annual Cost/Income Estimates – Alternative 6

	National Park Service	U.S. Forest Service	State of Montana	APHIS
Test/sample - phase 1	$10,000			$20,000
Test/sample - phase 2	40,000			25,000
Capture facilities at Stephens Creek and Seven-Mile Bridge - phase 1[1]	270,000			
Operations	294,000	$15,000		
Road plowing - phase 1 (10 years)	21,000			
Vaccination	150,000			2,000
Capture facilities - phase 2 (6)[1]	720,000			
Operations - phase 2 (3 years)	855,000			
Road plowing - phase 2 (3 years)	250,000–350,000			
Operations			$175,000	
Average income from the sale of meat, hides, and heads	Phase 2 - +278,000		Phase 1 - +33,000	
TOTALS	($745,000-phase 1 – $1,909,000-phase 2)	($15,000)	($142,000-phase 1 – $175,000-phase 2)	($47,000)

1. One time only (costs for Stephens Creek facility have already been incurred).

ALTERNATIVE 7: PREFERRED ALTERNATIVE – MANAGE FOR SPECIFIC BISON POPULATION RANGE

This alternative, like others evaluated in this environmental impact statement, involves many unknowns and assumptions about future conditions and available tools to manage the bison population. These assumptions represent what the agencies believe are most reasonable time frames for these tools to become available. Should one or more be available earlier or later than assumed for the purposes of analysis in this environmental impact statement, the impacts on several resources could be slightly different than indicated in the "Environmental Consequences." It is also possible that while one management option is approved in the time frame assumed, another might not. The agencies would use whichever tools were approved when they became available. Again, this might mean slightly different impacts than those described for alternative 7.

The preferred alternative includes the use of capture, test, and slaughter, the creation of special management areas (SMAs) in the Eagle Creek/Bear Creek area and west of the park, hazing and shooting bison outside the SMAs and on private lands within the SMAs, quarantine of some seronegative bison, hunting for recreational purposes and to help control bison distribution, vaccination of bison, the potential acquisition of additional winter range and the proposed creation of an SMA on that range as management tools.

As in all alternatives except alternative 5, the preferred alternative would allow bison outside park boundaries. This, or agency actions to manage bison on these lands, would require the creation of SMAs to protect Montana's class-free status, and the approval of the state of Montana as specified by Montana law to establish SMAs.

Use of quarantine as a management tool would provide the agencies flexibility in handling captured bison they do not now have. However, such a quarantine facility does not yet exist, and environmental compliance and public review would be required to examine alternative designs and locations before it could be built or operated on public land.

For purposes of analysis, the environmental impact statement assumes any required approvals to create SMAs would occur immediately upon signing the records of decision to implement the selected alternative and that the quarantine facility would be built and operating by the year 1999. If this proved not to be the case, the agencies would continue to rely on the capture, slaughter, hazing, and/or shooting of all bison attempting to exit the park at Reese Creek as described in the *Interim Bison Management Plan* under which the agencies now operate. When the facility was built, seronegative bison captured at the Stephens Creek facility would normally be transferred to quarantine, although at very low or very high population numbers this might not be the case (See "Population Management" section). Seronegative-pregnant bison captured at facilities inside the western SMA would also be quarantined and available for release following the successful completion of quarantine protocol.

Hunting is an additional management tool this alternative assumes would be available to help maintain a prescribed population size and distribution. The agencies would request the 1999 Montana Legislature to authorize a fair-chase hunt for bison. If authorized, the agencies would recommend Montana establish regulations for the public hunting of bison in a timely manner in accordance with applicable state laws. This analysis has assumed hunting would be available as a management tool in the year 2000. However, both authorization and appropriate state environmental compliance and public review would be completed before implementation of a bison hunt could begin.

This alternative, like all others, also assumes the use of a safe and effective vaccine on bison throughout the park, as well as the use of a safe vaccine on captured or quarantined bison. As the section on "Vaccination" in Actions Common to All Alternatives" indicates, a vaccine known to be safe and effective for bison, and safe for nontarget species does not currently exist, and the administration of a vaccine would require agreement from the agencies as well as possible environmental compliance and review. The decision on when a vaccine is safe and effective "enough" is complex and depends on a variety of factors. It is unknown when such a vaccine would be available, although the agencies believed it was reasonable to assume that vaccination would begin in the year 2000.

For purposes of analysis, this alternative also anticipates acquisition through purchase or easement of private property to the north of the park. This could only occur if the current owners of the property were willing to sell or grant easements on part or all of the property the agencies believed was useful for plan implementation, money was available for such a purchase, an organization or public entity agreed to manage the land, and all necessary environmental review and compliance was completed. Any or all of these conditions might or might not be met. The agencies are currently discussing the possible acquisition of land north of Yellowstone National Park, and have assumed for the purposes of analysis that the conditions would be met and purchase or easement would occur in the year 2000. The terms of the possible acquisition or easement at this time are unknown. In part because of these unknowns, this environmental impact statement analyzes the effect of the preferred alternative on bison distribution with and without the purchase or easement. This same information for impacts on other resources is available by comparing the environmental consequences sections for alternative 4, where acquisition was not anticipated.

The preferred alternative (alternative 7) departs from all other alternatives in that a range of bison population numbers is analyzed that differs from the other alternatives. This range is from 1,700 to 2,500 bison. Agency-implemented lethal controls would decrease as the population approached 1,700 bison and would cease at 1,700 bison in certain areas as described in management sections for each area. In general, hazing bison from areas where they were not permitted such as outside SMAs or on private land would be attempted before they were shot. Untested bison in the western SMA that posed a lower possibility of transmission of brucellosis and animals testing negative and previously released, would be allowed on public land during periods of the year that cattle were not present. Bison that posed a greater possibility of disease transmission would be removed. The state of Montana reserves the right to identify bison with a lower possibility of transmission according to such criteria as the state veterinarian and the Board of Livestock deem necessary to prevent brucellosis transmission from bison to cattle and to prevent import sanctions on Montana cattle by other states. The determination of animals in the western SMA that pose a lower possibility of transmission would be within the discretion of the Montana state veterinarian. The Montana state veterinarian would consult with APHIS and other state animal health authorities and use the best available science when making this determination (see appendixes A and G). Measures to remove increasing numbers of bison would be implemented as the population approached 2,500. However, the agencies might not be able to limit the herd to 2,500 because all lethal measures would occur at or outside the park boundary and in response to bison migrations.

In phase 2, it is assumed the agencies would acquire access to additional lands in the Gardiner Valley on the west side of the Yellowstone River for uses including winter range, siting the capture facility, and other bison management activities provided willing sellers were identified and funding was available. These lands would be evaluated along with other alternative sites for a quarantine facility. This might mean purchase of grazing rights, easements, or property from all willing sellers. Assuming land or easements were acquired and

placed under state or federal management, this area could be used for winter range, siting the capture facility, and other bison management activities. Physical barriers such as heavy jack-leg fencing might be placed at the north end next to the Yellowstone River to block bison movement. Protective fencing around small private inholdings could be constructed with landowner concurrence. Allowing bison outside the park in this area, should it be acquired, would require the creation of an SMA. For the remainder of this description, this SMA is referred to as the Reese Creek SMA. The capture facility now located at Stephens Creek could be dismantled and relocated to a suitable location north of the park boundary and south of Yankee Jim Canyon in this SMA.

Although the preferred alternative is distinct, it has elements similar to other alternatives. Capture and slaughter of seropositives is the primary means of managing risk, as it is in alternatives 1, 4, and 5. As many seronegative bison as possible would be shipped to a quarantine facility, as they would be in alternative 4. Also like alternative 4, low levels of hunting would be allowed in one or more of the SMAs outside the park. As in alternative 3, the preferred alternative allows the Stephens Creek facility to be moved to a suitable location north of the park boundary and south of Yankee Jim Canyon if the land was acquired under public ownership. However, as described above (and in the "Population Management" section below), this alternative is much more specific in defining a narrower population range and management actions to keep it within that range.

NORTHERN BOUNDARY

Reese Creek

If acquisition of land from willing sellers north of the park occurred, it would be evaluated as an alternate site for the Stephens Creek capture facility managed by the park. However, if lands were not acquired, the park would continue to operate the facility throughout the life of this plan. Features of the capture facility are described in alternative 1, and no changes in operation except the additional shipment of as many seronegative bison as possible to quarantine would be anticipated. Criteria listed in "Actions Common to All Alternatives" for the location of a capture facility would apply to siting such a facility if it were moved.

Management actions at the capture facility would vary, depending on the population size. Bison evading capture at the Stephens Creek facility (or at the new capture facility on acquired property, should this occur) might be shot or hazed on private land. If population numbers approached 1,700, agencies would haze bison in the park or capture facility if possible rather than shoot them. If population numbers approached 2,500, agency personnel would likely shoot bison when they occupied private land, rather than trying to haze them back into the park or capture facility.

Captured bison would be divided into groups for safety reasons and blood tested for exposure to *B. abortus*. Seropositive bison would be shipped to slaughter at approved slaughter facilities. Until a quarantine facility was approved, sited, and built, seronegative captured bison at Stephens Creek would also be shipped to slaughter, unless population numbers were approaching 1,700. If population numbers were low (approaching 1,700), seronegative bison might be held until weather moderated and released back into the park. Should such environmental conditions recur at low population numbers, the Stephens Creek capture facility might again be used to temporarily hold overwintering bison. The agencies estimate between 100 and 125 bison could be safely held in the Stephens Creek facility.

If bison numbers were approaching 2,500 and bison left the park, seronegative bison would be sent to quarantine for release following completion of protocol described in appendix B. Bison completing the full quarantine protocol would be made available to establish bison populations on tribal lands, other appropriate public lands, or provided to other appropriate public institutions or other qualified recipients.

When a safe vaccine was available, seronegative bison would also be vaccinated at the capture or quarantine facility. If the quarantine facility was full (and population numbers at or above 2,500), captured seronegative bison would be sent to slaughter.

In phase 2, these same functions could be relocated to a new capture facility on acquired lands north of the park boundary and south of Yankee Jim Canyon. This is dependent on the acquisition from willing sellers of private lands, easements, or grazing rights to property north of the park border to Yankee Jim Canyon (see Alternative 7 map). Changes to allotments on the north side of the park would be possible in phase 2.

Eagle Creek/Bear Creek

Agencies would monitor bison movements in the Eagle Creek/Bear Creek area and maintain a boundary at the Little Trail Creek/Maiden Basin hydrographic divide through limited hunting (if approved by the Montana Legislature), hazing, and agency shooting. Hunting would also keep population numbers lower and decrease the number of bison approaching the boundary at the Little Trail Creek/Maiden Basin hydrographic divide.

WESTERN BOUNDARY

Agencies would monitor and haze or shoot bison leaving the northern boundary (to the south of Buffalo Horn Creek) of the West Yellowstone area of the western SMA (see Alternative 7 map). Those leaving to the west along Hebgen Lake Dam would also be hazed or shot. Although hunting in the West Yellowstone area is not a part of the preferred alternative in phase 1, the agencies could include hunting as a population management tool in phase 2.

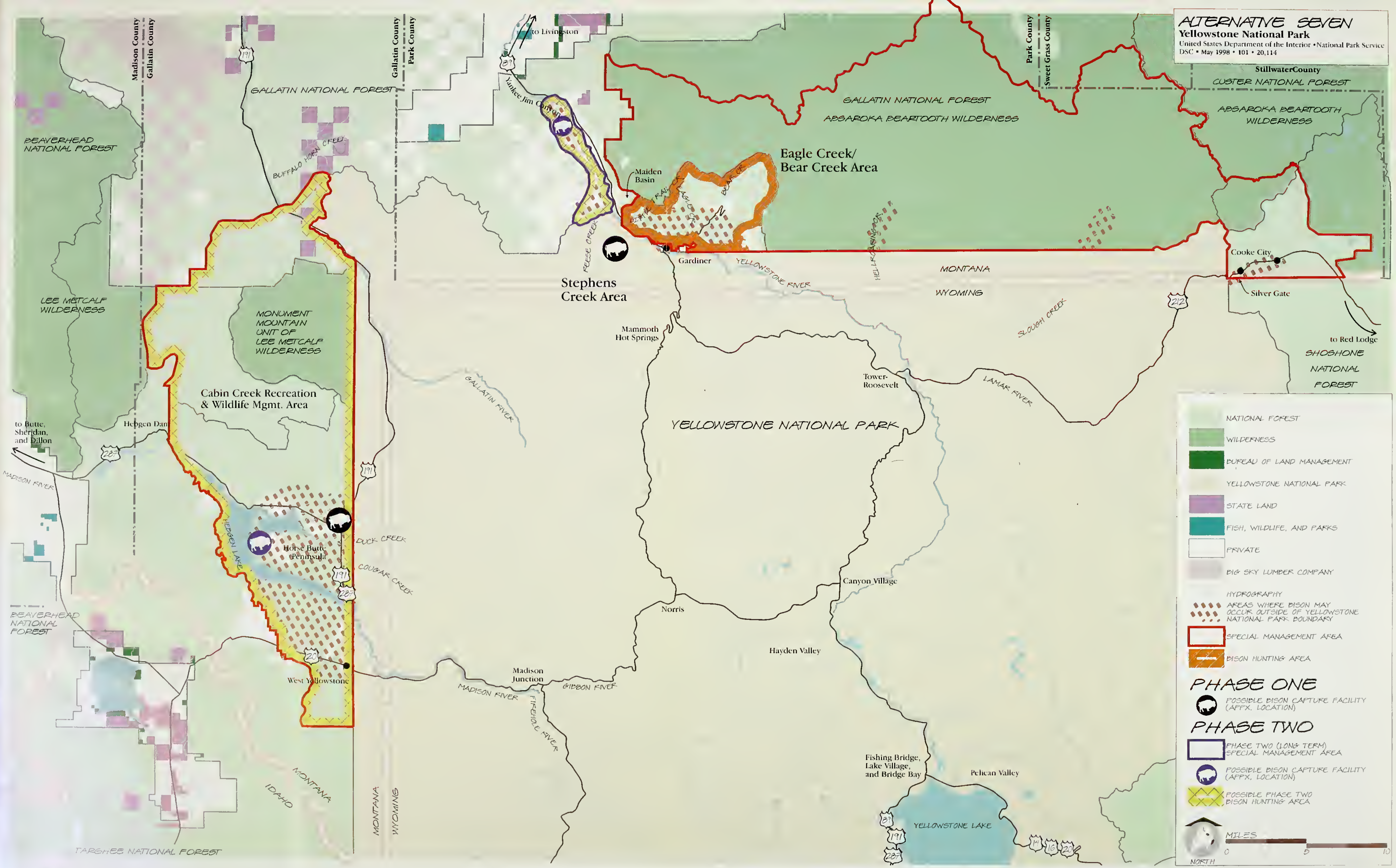
The state of Montana would continue to operate a capture facility on private land at Duck Creek in the western SMA. A second facility, located on public land along the Madison River, would be moved to the Horse Butte area to take advantage of changing bison migration routes. This capture facility would likely be located south of the Horse Butte village and east of the cattle guard going onto the butte to avoid the existing designated bald eagle protection area. It would be sited using criteria outlined in "Actions Common to All Alternatives" and operated jointly by the Animal and Plant Health Inspection Service and the National Park Service. Either of these capture facilities could be relocated in future winters if bison migration paths changed.

Bison would be moved into the facilities using bait, hazing, wing fences, or other appropriate methods. They would be tested for exposure to *B. abortus*, and all seropositive bison shipped to slaughter at an approved slaughterhouse. Seronegative-pregnant bison would be sent to quarantine. Normally (e.g., when population size is in the mid-range), seronegative-nonpregnant bison would be identified with a metal ear tag and a temporary visual marker and released onto public lands in the West Yellowstone area. The treatment of seronegative bison captured on the west side would change if populations levels approached the low (1,700) end or the high (2,500) end (see "Population Management" section below).

No changes in allotments or grazing rights on the west side of the analysis area would be anticipated in either phase 1 or phase 2.

SPECIAL MANAGEMENT AREAS

In this alternative, SMAs would be established in the Eagle Creek/Bear Creek area, the Hellroaring and Slough Creek drainages, and the West Yellowstone area south of Buffalo Horn Creek, including the Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness (see Alternative 7 map). If lands were acquired north of the park border at Reese Creek, they too could become an SMA. Any SMA requires the approval of the state of Montana as specified by Montana law.


ALTERNATIVE SEVEN
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • May 1998 • 101 • 20,114
Stillwater County
CUSTER NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
Park County
Sweet Grass County
Madison County
Gallatin County
Gallatin County
Park County
GALLATIN NATIONAL FOREST
to Livingston
Yankee Jim Canyon
BEAVERHEAD NATIONAL FOREST
BUFFALO HORN CREEK
Eagle Creek/
Bear Creek Area
Maiden Basin
Gardiner
Stephens Creek Area
Mammoth Hot Springs
YELLOWSTONE RIVER
MONTANA
WYOMING
SLOUGH CREEK
Cooke City
Silver Gate
to Red Lodge
SHOSHONE NATIONAL FOREST
LEE METCALF WILDERNESS
MONUMENT MOUNTAIN UNIT OF LEE METCALF WILDERNESS
Cabin Creek Recreation & Wildlife Mgmt. Area
GALLATIN RIVER
Tower-Roosevelt
LAMAR RIVER
YELLOWSTONE NATIONAL PARK
to Butte, Sheridan, and Dillon
Hebgen Dam
MADISON RIVER
HEBGEN LAKE
Horse Butte Peninsula
DUCK CREEK
COUGAR CREEK
Canyon Village
Norris
Hayden Valley
BEAVERHEAD NATIONAL FOREST
West Yellowstone
Madison Junction
MADISON RIVER
GIBBON RIVER
FIREHOLE RIVER
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
MONTANA
IDAHO
MONTANA
WYOMING
TARGHEE NATIONAL FOREST
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
AREAS WHERE BISON MAY OCCUR OUTSIDE OF YELLOWSTONE NATIONAL PARK BOUNDARY
SPECIAL MANAGEMENT AREA
BISON HUNTING AREA
PHASE ONE
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
PHASE TWO
PHASE TWO (LONG TERM) SPECIAL MANAGEMENT AREA
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
POSSIBLE PHASE TWO BISON HUNTING AREA
MILES
0
5
10
NORTH

Agencies would use the management tools described in the "Northern Boundary" and "Western Boundary" sections of this alternative. Although hunting in the Reese Creek SMA is not part of the alternative in phase 1, it might become a part later if agencies felt it was appropriate and the legislature approved it. If so, the number of hunting permits would be increased when the population level approached 2,500, and decreased when it approached 1,700. The details of the hunt and how it would be conducted would be similar to those described in alternative 3, although the number of permits would likely be more limited.

A limited public hunt in the Eagle Creek/Bear Creek SMA would be used to help control population numbers and distribution and to provide recreation. The hunt would likely run between October 1 and February 28 (see the description in "Population Management" section below).

Cattle would continue to be grazed on Gallatin National Forest lands in the West Yellowstone area from about June 15 to October 30. Cattle graze on private land from approximately June 1 to November 15. Bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Seronegative-nonpregnant bison released from capture facilities on the west side would be allowed back into the SMA following the departure of livestock if populations were in the low or mid range. If the bison herd was approaching 2,500, a larger proportion of captured seronegatives would be shipped to quarantine rather than released.

If population numbers were high, bison would be shot by agencies (by request or with permission of the landowner) if they occupied private lands in or attempted to leave the SMA. If numbers were low, it would be the preference of the agencies to use hazing as a primary tool to keep bison off private land or from crossing out of the western SMA. If hazing was unsuccessful or the private landowner would not allow hazing, the agencies would shoot bison identified for removal. Very high elevation country to the west would help keep bison confined to the SMA.

Bison would be able to occupy the Cabin Creek Recreation and Wildlife Management Area and Monument Mountain Unit of the Lee Metcalf Wilderness to the north of the West Yellowstone area without agency management. These lands are without livestock allotments, although topography and snow depths limit the number of bison that actually use them.

Hunting bison in the western SMA might be considered as an adjunct to capture operations. If so, it would be used to help manage population size and distribution. The number of hunting permits issued would increase when the population approached 2,500, and decrease as it approached 1,700.

As described above, the Duck Creek capture facility would continue to operate at its present location, and a second west side capture facility would likely be built at Horse Butte.

RISK MANAGEMENT

Alternative 7 would rely on separation, capture, slaughter of seropositives, and vaccination of bison to reduce the risk of brucellosis transmission.

The primary means to ensure separation of cattle and bison would be the enforcement of controlled entry at the northern border and in the western SMA as described above, and temporal separation in the western SMA. On the north end, agencies would use monitoring, hazing, capture, slaughter of seropositives, and agency shooting to maintain separation at Reese Creek. At Eagle Creek/Bear Creek, monitoring, hazing, hunting, and agency shooting would prevent entry into the Gardiner area. If land was acquired north of the park and a Reese Creek SMA was established, hunting could be used in the SMA

to help control population numbers and distribution.

In the West Yellowstone area, temporal separation would be maintained by allowing seronegative-nonpregnant bison in the area in the winter months and cattle in the summer. To prevent commingling of bison and cattle, bison would hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Bison would not be allowed in the SMA until cattle have been removed in October/November. Hunting, if it was approved, would help control population numbers and distribution. Topography, availability of habitat, hazing, hunting, and agency shooting would keep bison from moving beyond SMA boundaries or onto private land.

In addition to separation, this alternative would reduce risk of transmission to cattle in the West Yellowstone area of the western SMA through capture and slaughter of seropositives in two the capture facilities described above.

Seronegative-pregnant females and bison that posed a greater possibility of disease transmission, including pregnant, untested females or females with newborn calves who have not passed all birth membranes would be captured and quarantined or removed. Removing pregnant bison would ensure no birth materials are left behind when cattle reoccupy the area in the summer. Removal could be through shooting, or if logistically feasible, through immobilization via dart. If the bison has a newborn calf, the calf would be captured by hand or darted. The immobilized animals would be transported back into the park, to quarantine, or to an approved research facility. (Experience to date indicates the chance of a female with a newborn calf who has not passed all birth membranes appearing in the western boundary area is very low. None was observed in any of the past bison control operations.)

Operators in the West Yellowstone area of the western SMA on public lands would be encouraged to vaccinate female cattle calves against brucellosis. Operators in all other boundary areas would be encouraged to annually vaccinate all subadult cattle as well as calves. Cattle herds in contact areas would continue to be surveillance tested periodically, and any herd whose member or members might have come in contact with bison would be checked for exposure. Livestock owners on private property would continue to be responsible for all costs and materials associated with calfhood vaccination.

When a vaccine was developed that was determined safe for bison and nontarget animals, it would be administered to captured bison and bison placed in quarantine. When a safe and effective vaccine was developed, it would be administered through remote means to free-ranging bison.

POPULATION MANAGEMENT

Bison population numbers at the northern park boundary would be controlled through the increasing or decreasing use of lethal methods to manage bison. At low population numbers, if bison crossed the Reese Creek boundary onto private land, the agencies would attempt to haze the bison back into the park. If hazing was unsuccessful or the private landowner would not allow hazing, the agencies would shoot those bison on private land. If winter conditions were very severe, some bison could be held and fed at the capture facility throughout the remainder of the winter. If lands north of the park were acquired and a Reese Creek SMA was established on the west side of the Yellowstone River, bison would be hazed off private land within the SMA if population numbers remained low. If hazing was unsuccessful or the private landowner would not allow hazing, the agencies would shoot those bison on private land within the SMA. Also, if hunting was approved in the SMA, few or no permits would be issued if the herd size was approaching 1,700.

If the bison population approached 2,500 and bison approached the SMA boundary, captured seronegative bison would be sent to quarantine. If the quarantine facility was full, seronegative bison would be sent to slaughter. Bison released from quarantine would be made available to establish bison populations on tribal lands, other appropriate public lands, or provided to other appropriate public institutions or other qualified recipients. In phase 1, bison crossing the park boundary at Reese Creek would be shot on private land. In phase 2, bison going beyond the SMA boundary would be shot by agencies. If the Reese Creek SMA was created, bison on private land within its boundary would be shot upon landowner request. If hunting was approved in the new SMA, increasing numbers of permits would probably be issued as population numbers approached 2,500.

Hunting permits for the Eagle Creek/Bear Creek area would also increase or decrease, depending on the size of the herd. Agencies would attempt to haze bison back into the Eagle Creek/Bear Creek SMA if possible at low population levels and would rely more on shooting to maintain the boundary at Little Trail Creek/Maiden Basin hydrographic divide at higher population levels.

The agencies would use the same types of methods in the western SMA to control population size. When population numbers were low, bison would be hazed off private land, rather than shot. Those attempting to leave the SMA would be hazed if possible, and shot only as a last resort.

Bison would continue to be captured on the west side as the population approaches the low end (1,700 animals). All bison posing a lower risk of transmission and animals testing negative and previously released would be allowed on public lands in the SMA.

All bison in the SMA would be hazed back into the park in May to facilitate reoccupation of the area by cattle in the summer. If hunting was approved in this SMA, no permits would be issued until the population grew beyond 1,700.

If the population was in the mid range, seronegative-nonpregnant bison captured at the two existing capture facilities on the west side would be released onto public lands. Seronegative-pregnant bison would be sent to quarantine.

When the population numbers approached 2,500, agencies would shoot bison on private land or those bison attempting to leave the SMA. All seronegative bison captured in the two facilities operating in the western SMA would be shipped to quarantine provided facility space was available and those bison would be released upon completion of quarantine protocol to establish bison populations on tribal lands, other appropriate public lands, or provided to other appropriate public institutions or qualified recipients.

Quarantine

A quarantine facility would be proposed (e.g., when population levels were not approaching 1,700 and bison were migrating out of the park) to give agencies flexibility in handling captured bison that they do not now have (see alternative 3). It would also provide a source of live, disease-free bison for tribal governments, requesting organizations, or to establish populations on other public lands. Seronegative bison could be shipped to the quarantine facility and complete an approved protocol to ensure they were disease free. When they have completed the quarantine protocol described in appendix B, they could be released to establish bison populations on tribal lands, other appropriate public lands, or provided to other appropriate public institutions and qualified recipients. Any bison showing signs of exposure to *B. abortus* during the quarantine period would be slaughtered, and testing of the remaining bison in contact with it begun again. Because of this, bison might need to remain in quarantine for several years to be declared disease free. Bison successfully completing the full quarantine procedure without contact with any infected animals would be available for release (see "Quarantine" section in alternative 3 for

more information on facility description and procedures). The agencies would sign a memorandum of understanding to formalize commitments regarding a quarantine facility should the preferred alternative or another alternative including quarantine be selected. Details of the design, location, and other factors would be decided following appropriate environmental review and compliance.

Public Hunting

Upon issuance of the records of decision, the agencies would request the Montana Legislature authorize Montana to establish regulations for the public hunting of bison. If approved, regulated public hunting seasons would be administered to help control bison numbers and provide recreation on public lands in the Eagle Creek/Bear Creek area. In addition to controlling bison numbers, hunting would also help prevent bison on public lands in the Eagle Creek/Bear Creek area from migrating to private lands. Hunting might also be allowed in the West Yellowstone and other SMAs. If so, it would be used to help remove bison from private lands in both areas, and in maintaining bison population and distribution.

Regulations likely would authorize a season that would begin no earlier than October 1 and end no later than February 28, with several designated hunting periods within the season. Individual licensed hunters would be authorized to hunt during one designated hunting period. The regulations would specify a quota on the number of licenses to be issued for each area during each hunting season. Each licensed hunter could legally take one bison of any age and of either sex.

Each hunter interested in participating in the bison season would submit an application for a license, similar to an application for other special hunting licenses. Applicants would submit the fees for the license and a processing fee with the application.

Hunting would begin in the year 2000 at the earliest. Based on bison population numbers, winter distribution on public and private lands, and other factors, the agencies might conduct additional special drawings to harvest additional bison (see additional details of the hunt in the description of alternative 3).

ESTIMATE OF COST

Table 8 indicates the costs that would be incurred by the interagency team for alternative 7.

Table 8 : Annual Cost/Income Estimates – Alternative 7: Preferred Alternative

	National Park Service	U.S. Forest Service	State of Montana	APHIS	Shared Costs
Test/sample				$25,000	
Capture facility (Stephens Creek)[1]	$120,000				
Capture facility (west area)[1]			$175,000	50,000	
Operations at capture facilities	337,000	$15,000	225,000	100,000	
Hunting operations		10,000	50,000		
Equipment, repair, replacement	66,000				
Vaccination	150,000			8,000	
Relocate Stephens Creek capture facility[1]	60,000				
Quarantine facility[1]				500,000–800,000[2]	
Quarantine operations (50 bison /yr)				400,000	
Acquisition[1]					$29.1 million
Easement[1]					Unknown[3]
Conversion of livestock operations[1]					Unknown[3]
Wildlife/winter use monitoring		5,000			
Average income from the sale of meat, hides, and heads			+46,800		
TOTALS	($733,000)	($30,000)	($403,200)	($1,083,000 – $1,383,000)	(Up to $29.1 million)

1. One time only capital costs.
2. Does not include land costs for quarantine facility.
3. Easement and conversion would substitute for acquisition, and costs would be less than $29.1 million.

ALTERNATIVES CONSIDERED BUT REJECTED

A segment of the public asked that agencies develop alternatives that used no lethal controls and that allowed bison to exist with no restrictions on their distribution or population size. This alternative would not resolve need or meet the purpose of the plan (see the "Purpose of and Need for Action"), and was therefore eliminated from full-scale analysis and consideration, although it was considered thoughtfully before doing so. Information and conclusions from the preliminary analysis of this alternative is presented below to show a "no management" baseline.

If bison were allowed to freely leave Yellowstone National Park, they would move north into the Gardiner, Paradise, and Yellowstone River valleys and west along the Madison River, Duck Creek, and Cougar Creek into the Madison River valley. The continental divide lies to the west of these areas, but bison could travel north, south, and east, and potentially reinhabit adjacent river valleys.

As bison travel onto private lands, or onto public lands where cattle are grazed, the chances of contact and of the transmission of brucellosis would increase, jeopardizing the state's class-free status. If the disease were to spread undetected, it could quickly move to other states since Montana exports breeding cattle. As bison move into populated areas, the risk of human injury and private property damage would increase. Areas to the north and west of the park have experienced significant increases in human occupation and development over the past few years, and this trend is not expected to change. Additional traffic accidents involving bison would likely occur as well. The corresponding social and economic consequences would be substantial.

Additional alternatives were considered but rejected for reasons outlined in the "Public Scoping" section of the "Purpose of and Need for Action."

HOW ALTERNATIVES MEET STATED OBJECTIVES

The interagency team included methods in each of the alternatives to ensure they met the nine stated objectives (see "Objectives and Constraints" section of the "Purpose of and Need for Action") to some degree. These are listed in table 9. Many of these objectives are discussed in more detail in both the "Objectives and Constraints" section of the "Purpose of and Need for Action," and in the description of each alternative in part 2, "The Alternatives."

Table 9: Methods Each Alternative Uses to Ensure Each Agreed-upon Objective Is Met

Objective	Alternative 1: No Action - Continuation of the Current Interim Bison Management Plan	Alternative 2: Minimal Management	Alternative 3: Management with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Preferred Alternative – Manage for Specific Bison Population Range
1. Address bison population size and distribution; have specific commitments relating to size of bison herd	Overall size not specified in *Interim Bison Management Plan*; distribution (winter numbers): Eagle Creek/Bear Creek - 100–200, Reese Creek - 0; West Yellowstone - 50–100; no commingling of bison/cattle per landowner discretion; capture/slaughter and agency shooting controls distribution	Overall size: 1,700 to whatever environmental conditions dictate; road closure controls distribution; limited by landowner tolerance; acquire additional winter range; allow bison on all public land inside line; distribution (winter numbers): Eagle Creek/Bear Creek - 100–200, Gardiner Valley area - 200; West Yellowstone - 50–100	Overall size: 1,700–3,500; West Yellowstone and Eagle Creek/Bear Creek: hunting program to regulate numbers/ distribution; Reese Creek: capture/slaughter - run capture facility until additional winter range acquired; quarantine seronegatives: Eagle Creek/Bear Creek - 100–200, Reese Creek SMA - 50–100; W. Yellowstone - 50–100	Overall size: 1,700–3,500; distribution (winter numbers): Eagle Creek/Bear Creek - 100–200; Reese Creek - 0; West Yellowstone - 50–100; capture, test, slaughter, or quarantine, shooting to control distribution; hunting in Eagle Creek/Bear Creek and West Yellowstone; remove seronegatives captured at Reese Creek to control numbers	Distribution limited to Yellowstone National Park; agencies capture/test/ slaughter seropositives parkwide; shoot strays; population size dictated by disease control success	Overall size: 1,700–3,500; distribution (winter numbers): Eagle Creek/Bear Creek - 100–200; Reese Creek - 0; West Yellowstone - 50–100; capture, test, slaughter, shooting; capture at Seven-Mile Bridge; incidental hunting at Eagle Creek/Bear Creek and West Yellowstone may help control numbers; capture and slaughter control distribution	Overall size: 1,700– 2,500: Eagle Creek/Bear Creek - 100–200; Reese Creek SMA - 50–100; West Yellowstone - 50–100; capture, test, slaughter and quarantine, shooting, limited hunting in Eagle Creek/Bear Creek and West Yellowstone control numbers and distribution; specific measures at specific population ranges
2. Clearly define a boundary line beyond which bison will not be tolerated	Maiden/Little Trail, Reese Creek, on north; West Yellowstone/Horse Butte/north boundary of Cabin Creek; Hebgen Lake on west side	Yankee Jim Canyon on north; Buffalo Horn Creek; Hebgen Lake on west side	Yankee Jim Canyon, west side of Yellowstone River and Gardiner; Little Creek/Maiden Basin on east side of river; Cabin Creek, Hebgen Lake on west side	Same as alternative 1	All bison restricted to Yellowstone National Park	Inside Yellowstone National Park; Eagle Creek/Bear Creek; West Yellowstone, Horse Butte	Same as alternative 3
3. Address the risk to public safety and private property damage by bison	Removal at landowner request or by Department of Livestock	Same as alternative 1	Removal at landowner request or by Department of Livestock; West Yellowstone - hunting on private lands with agreement by landowners	Removal at landowner request or by Department of Livestock; special hunt on private land	Same as alternative 1	Same as alternative 1	Same as alternative 4
4. Commit to the eventual elimination of brucellosis in bison	Vaccinate bison when safe and effective vaccine developed; capture/slaughter seropositives in West Yellowstone; slaughter all at Reese Creek	Vaccinate bison when safe and effective vaccine developed	Vaccinate bison when safe and effective vaccine developed; slaughter seropositives; remove seronegatives captured at Reese Creek	Vaccinate bison when safe and effective vaccine developed; capture/slaughter seropositives; remove seronegatives captured at Reese Creek	Parkwide capture and slaughter of seropositives; vaccinate when safe and effective vaccine developed	Capture/slaughter seropositives at Reese Creek/Seven-Mile Bridge; parkwide vaccination until seropositive rate plateaus; then parkwide capture and slaughter of seropositives	Vaccinate bison when safe and effective vaccine developed; slaughter seropositives; quarantine seronegatives captured at Reese Creek
5. Protect livestock from the risk of brucellosis	Monitor movement; test/slaughter all seropositives (and some seronegatives); vaccinate bison/cattle; enforced boundary; remove on private land; surveillance testing; test/vaccinate adult contact cattle; shoot on private land or crossing out of SMAs	Monitor movement; modify livestock use where bison present; public acquisition of private land; easements; modify cattle allotments and operations in SMAs; hazing; shoot on private land or crossing out of SMAs; boundary control; vaccinate cattle in SMA; surveillance testing; test/vaccinate adult contact cattle; vaccinate bison calves	Monitor movement; capture/ slaughter seropositives (phase 1); hunting; temporal separation in West Yellowstone with possible changes in allotments in phase 2; public acquisition of winter range, easements, or modifications in cattle operations; surveillance testing; test/vaccinate adult contact cattle; vaccinate bison calves; haze or shoot on private land or crossing out of SMAs	Monitor movement; test/slaughter seropositives; vaccinate bison/cattle; enforced boundary; hunting to remove at West Yellowstone; remove on private land; surveillance testing; test/vaccinate adult contact cattle; shooting on private land or crossing out of SMAs	Restrict to park; capture/test/ vaccinate/ slaughter inside Yellowstone National park; monitor movement; vaccinate cattle; surveillance testing; shoot on private land	Vaccinate bison; capture/test/ slaughter; vaccinate cattle; monitor movement; surveillance testing; shoot on private land or crossing out of SMAs	Monitor movement; test/slaughter seropositives; vaccinate bison/cattle; enforced boundary; remove bison on private land; surveillance testing; test/vaccinate adult contact cattle; public acquisition of winter range; haze or shooting on private land or crossing out of SMAs
6. Protect the state of Montana from risk of reduction in its brucellosis status	Designate SMAs; adopt above measures to protect livestock from risk of brucellosis	Designate SMAs; adopt above measures to protect livestock from risk of brucellosis	Designate SMAs; adopt above measures to protect livestock from risk of brucellosis	Designate SMAs; adopt above measures to protect livestock from risk of brucellosis	Adopt above measures to protect livestock from risk of brucellosis	Designate SMAs; adopt above measures to protect livestock from risk of brucellosis	Designate SMAs; adopt above measures to protect livestock from risk of brucellosis

Objective	Alternative 1: No Action - Continuation of the Current Interim Bison Management Plan	Alternative 2: Minimal Management	Alternative 3: Management with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Preferred Alternative – Manage for Specific Bison Population Range
7. At a minimum, maintain a viable population of wild bison in park, as defined in biological, genetic, and ecological terms	Discussion process to develop contingency measures	Increase available winter habitat through modifications in cattle allotments, private cattle operations, etc.	Increase available winter habitat through modifications in cattle allotments, private cattle operations, etc.; reduce number of hunting permits issued; use capture facilities to hold bison for park release	Reduce number of hunting permits issued; release live, rather than quarantine and remove	Slow down pace of bison eradication	Same as alternative 5, plus reduce number of hunting permits issued	Haze instead of shoot bison on private land or crossing SMA boundary; release rather than quarantine seronegatives, use capture facilities to overwinter bison in severe winters
8. Be based on factual information, with the recognition that the scientific database is changing	Ongoing research to develop safe, effective vaccine; better blood test; understand intra- and inter-species transmission; estimates of minimum population; brucellosis pathology and epidemiology in bison	Same as alternative 1 except add research effects of road grooming on bison migration	Same as alternative 2	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 2
9. Recognize the need for coordination in the management of natural and cultural resource values that are the responsibility of signatory agencies	Apply laws, constraints for siting facilities, consultation/coordination; specify cooperative responsibilities	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1

Table 10: Summary Comparison of Alternative Actions

Action	Alternative 1: No Action – Continuation of the Current Interim Bison Management Plan	Alternative 2: Minimal Management	Alternative 3: Management, with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Preferred Alternative – Manage for Specific Bison Population Range
Bison population range	No range specified in existing interim plan	Allow natural forces to determine herd size	Manage herd within range of natural variation: 1,700–3,500	Same as alternative 3	Manage herd size to prevent loss of genetic integrity and ensure success of disease control	Same as alternative 5	Manage herd within range of 1,700 to 2,500
Capture, test, and slaughter operations	Reese Creek: capture all bison at Stephens Creek facility inside park and ship to slaughter; West Yellowstone: capture, test, and ship seropositive males and females and all pregnant females to slaughter; test and release seronegative male and nonpregnant females on public land; capture facilities on national forest and/or private land used during winter months	Phase 1 same as alternative 1; phase 2 no capture, test, and slaughter operations	Reese Creek: in phase 1, ship all seropositives to slaughter, seronegatives to quarantine; in phase 2, capture facility between Yankee Jim Canyon and Reese Creek as backup to hunting; West Yellowstone: no capture facilities	Capture facilities same as alternative 1, except ship seronegatives from Reese Creek to quarantine	Temporary capture facilities throughout park; test; ship all seropositives to slaughter and release all seronegatives within park; Stephens Creek facility remains	Reese Creek: ship all captured bison to slaughter; West Yellowstone capture facility at Seven-Mile Bridge area inside park; test and ship seropositives to slaughter; test, vaccinate, and release all seronegatives onsite; phase 2 capture facilities same as alternative 5	Reese Creek: in phase 1, ship all seropositives to slaughter, seronegatives to quarantine; in phase 2 , capture facility between Yankee Jim Canyon and Reese Creek; West Yellowstone: same as alternative 1 except quarantine all seronegatives at high population levels and all seronegative-pregnant bison at population mid range; capture facility at Horse Butte
Quarantine operations	No quarantine operations	No quarantine operations	Quarantine operations – take seronegatives from Stephens Creek in phase 1; relocate capture facility in phase 2	Quarantine operations – Reese Creek: quarantine all seronegatives; West Yellowstone: quarantine seronegative-pregnant females	No quarantine operations	No quarantine operations	Quarantine operations – take seronegatives from Stephens Creek in phase 1; West Yellowstone; quarantine seronegative-pregnant females; if population high, quarantine all seronegatives
Monitoring of bison	Aerial and ground reconnaissance of bison in and adjacent to park	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1 and monitor bison to facilitate capture inside park	Phase 1, same as alternative 1; phase 2, same as alternative 5	Same as alternative 1
Bison hunting	No hunt	No hunt	If legislature approves, state of Montana institutes fair-chase hunt on public and private land in all SMAs; public hunt during winter (Oct.-Feb.) primary method to control population numbers and distribution	If legislature approves, state of Montana institutes fair-chase hunt on public lands; public recreational hunt during winter (Oct.-Feb.)	No hunt	No hunt	If legislature approves, state of Montana institutes fair-chase hunt on public lands at Eagle Creek/Bear Creek; in phase 2, hunting could be allowed on public lands in all SMAs
Bison management on public lands adjacent to Yellowstone National Park	Allow bison on public lands in Eagle Creek/Bear Creek except north of Little Trail Creek/Maiden Basin hydrographic divide; do not allow bison north of Reese Creek; do not allow bison in West Yellowstone area beyond May and until November 1	Allow bison on public lands in Eagle Creek/Bear Creek; in Gardiner Valley south of Yankee Jim Canyon; and south of Buffalo Horn Creek and east of Hebgen Lake in western area	Allow bison on public lands in Eagle Creek/Bear Creek except north of Little Trail Creek/Maiden Basin hydrographic divide; do not allow bison in West Yellowstone area beyond May and until November 1; in phase 1, bison not allowed north of Reese Creek; phase 2, bison allowed between Reese Creek and Yankee Jim Canyon	Same as alternative 1	Do not allow bison outside park; haze to return bison to interior of park	Same as alternative 1	Allow bison on public lands in Eagle Creek/Bear Creek except north of Little Trail Creek/Maiden Basin hydrographic divide; do not allow bison in West Yellowstone area beyond May and until November 1; in phase 1, bison not allowed north of Reese Creek; in phase 2, bison allowed between Reese Creek and Yankee Jim Canyon
Bison management on private lands adjacent to Yellowstone National Park	Remove bison at landowner request	Same as alternative 1	Bison hunted with landowner permission; remove at landowner request	Remove bison at landowner request; possible bison hunt under special and limited circumstances	Same as alternative 1	Same as alternative 1	Same as alternative 3
Surveillance testing of cattle	No change in existing cattle surveillance requirements	Require testing of susceptible cattle in SMA	Require testing of cattle in contact with bison	Same as alternative 3	Same as alternative 1	Require testing of cattle in high-risk areas in West Yellowstone	Whole herd surveillance protocols for cattle within SMAs recommended by APHIS

Action	Alternative 1: No Action – Continuation of the Current Interim Bison Management Plan	Alternative 2: Minimal Management	Alternative 3: Management, with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Preferred Alternative – Manage for Specific Bison Population Range
Vaccination of cattle with RB51	Encourage calfhood vaccination of cattle adjacent to park	Encourage vaccination of all susceptible female cattle calves within SMA, adjacent to park or within 20-mile radius of either	Same as alternative 2	Same as alternative 2	Same as alternative 1	Same as alternative 2	Same as alternative 2
Vaccination of bison	Vaccinate bison calves after vaccine is developed that is safe and effective for bison using capture facilities and remote means	Same as alternative 1, using remote means only	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1
Modify national forest grazing allotments	No modification of national forest grazing allotments	Modification of national forest grazing allotments may occur	No modification of national forest grazing allotments expected in phase 1, but may occur in phase 2	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 3
Change in land use, easement, or acquisition of additional wildlife habitat	No change in existing land use/ownership	Easement or acquisition of additional winter wildlife habitat; or change from breeder cattle (susceptible cattle) to steers/spayed heifers within SMA	Similar to alternative 2, with reduced acquisition	Same as alternative 1	Same as alternative 1	Same as alternative 1	Phase 1, no change; phase 2, acquire additional winter range north of Reese Creek; no changes in cattle operations
Winter road grooming	No change in existing winter road management	Eliminate winter grooming and snowmobile use of some trails; research effects of closures on population numbers and on ability to keep bison within park boundaries	Research effects of road closures on bison	Same as alternative 1	Plow roads in winter for access to bison capture facilities	Phase 1 - plow road to Seven-Mile Bridge capture facility; phase 2 - plow roads same as in alternative 5	Same as alternative 1
Total annual cost of alternative (includes one-time only costs such as quarantine, capture facilities, and land acquisition)	• NPS – $450,000 • USFS – $15,000 • State of MT – $140,000-$420,000 • APHIS – $183,000	• NPS – $232,000 • USFS – $170,000 • State of MT – $150,000 • APHIS – $30,000 • Shared costs (up to $44.1 million)	• NPS – $488,000 • USFS – $40,000 • State of MT – $225,000 • APHIS – $933,000-$1,233,000 • Shared costs (up to $33.1 million)	• NPS – $428,000 • USFS – $25,000 • State of MT – $408,000 • APHIS – $1,078,000-$1,378,000	• NPS – $2,135,300-$2,235,300 • USFS – $15,000 • State of MT – 0 • APHIS – $51,000	• NPS – $745,000 (phase 1) $1,909,000 (phase 2) • USFS – $15,000 • State of MT – $142,000 (phase 1) $175,000 (phase 2) • APHIS – $47,000	• NPS – $733,000 • USFS – $30,000 • State of MT – $403,200 • APHIS – $1,083,000-$1,383,000 • Shared costs (up to $29.1 million)

TABLE 11: COMPARISON OF FEATURES OF EACH ALTERNATIVE

Action	Alternative 1: No Action – Continuation of the Current Interim Bison Management Plan	Alternative 2: Minimal Management	Alternative 3: Management, with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Slaughter	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Preferred Alternative – Manage for Specific Bison Population Range
Agency-enforced boundary control at Reese Creek	✓	✓ (phase 1)	✓ (phase 1)	✓	✓	✓	✓(phase 1)
Agency enforced boundary control at Little Trail Creek/Maiden Basin divide	✓	✓ (phase 1)	✓	✓		✓	✓
Bison shot inside Eagle Creek/Bear Creek area			✓ (hunt)	✓ (hunt)	✓ (agency)		
Agency-enforced boundary at Yankee Jim Canyon (northern boundary beyond Reese Creek)		✓	✓ (phase 2)				✓ (phase 2)
Agency-enforced boundary at Cabin Creek area boundary on western side	✓		✓	✓		✓	✓
Agency-enforced boundary at Buffalo Horn Creek on western side		✓					
Capture facility at Stephens Creek (northern, Reese Creek boundary inside park)	✓	✓ (phase 1)	✓ (phase 1)	✓	✓	✓	✓(phase 1)
Capture facilities at Duck Creek and Madison River (western boundary)	✓	✓ (phase 1)		✓	✓		
Capture facilities at several locations inside park					✓	✓ (phase 2)	
Capture facilities at Duck Creek and Horse Butte (western boundary)							✓
Capture facilities at Seven-Mile Bridge (western boundary inside park)						✓	
Seronegative bison from Stephens Creek slaughtered	✓	✓ (phase 1)			✓	✓	
Seronegative bison from Stephens Creek quarantined			✓	✓			✓
Seronegative-nonpregnant bison from West Yellowstone capture facilities released onsite	✓	✓ (phase 1)		✓		✓	✓
Seronegative-pregnant bison from West Yellowstone slaughtered	✓	✓ (phase 1)					
Seronegative-pregnant bison from West Yellowstone quarantined				✓			✓(at high population levels)
Seronegative-pregnant bison from West Yellowstone released onsite						✓	
Quarantine facilities			✓	✓			✓

Action	Alternative 1: No Action – Continuation of the Current Interim Bison Management Plan	Alternative 2: Minimal Management	Alternative 3: Management, with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Slaughter	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Preferred Alternative – Manage for Specific Bison Population Range
Bison hazed into capture facilities, away from borders	✓	✓ (phase 1)	✓	✓	✓	✓	✓
Bison crossing boundaries shot	✓	✓	✓	✓	✓	✓	✓
SMA in Eagle Creek/Bear Creek	✓	✓	✓	✓		✓	✓
SMA between Reese Creek and Yankee Jim Canyon on west side of Yellowstone River only			✓				✓
SMA between Reese Creek and Yankee Jim Canyon on east and west side of Yellowstone River		✓					
Western SMA including Horse Butte area	✓	✓	✓	✓		✓	✓
Western SMA includes Cabin Creek/Lee Metcalf area	✓	✓	✓	✓		✓	✓
Western SMA includes all land south of Buffalo Horn Creek		✓					
Bison hazed back into park from West Yellowstone in May	✓	✓ (phase 1)	✓ (phase 1)	✓		✓	✓
Bison hunted in West Yellowstone area			✓	✓ (limited)			✓ (possible)

Table 12: Summary Comparison of Impacts of Alternatives

The following terms are used in this impact summary chart and throughout the environmental impact statement. In some cases, the terms are defined quantitatively. However, when they are not, the following definitions apply:

- Negligible – at lower levels of detection
- Minor – detectable, but slight
- Moderate – readily apparent environmental effects with the potential to become major
- Major – severe adverse or exceptional beneficial effects

Topic	Alternative 1: No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7: Preferred Alternative
IMPACTS ON THE BISON POPULATION							
Estimated population size (# bison) in 2006 or later	3,100 in 2006	3,500 in 2006; moderate increase	3,500 in 2006; moderate increase	2,800 in 2006; minor decrease	2,150 in 1997 to 1,250 in 1999; up to 2,000 by 2006; major decrease	3,500 in 2010; 2,500- 2,900 in 2011; moderate to major decrease	2,700 in both 2006 and 2011; moderate to major decrease
Estimated distribution in West Yellowstone	18–52 bison	20-60 bison	16–120 bison	1–52 bison	0 bison	22–60 bison	13–51 bison
Estimated distribution in Reese Creek	0 bison	0-120 bison	60-80 bison	0 bison	0 bison	0 bison	0-100 bison
Estimated sero-prevalence rate in 2011 (70% vaccine efficacy assumed)	24%	26%; minor adverse impact	28%; minor to moderate adverse impact	26%; minor adverse impact	0%; major beneficial impact	0% by 2013; major beneficial impact	23%; negligible to minor beneficial impact
IMPACTS ON RECREATION							
Visitor experience	Minor adverse and positive impacts	No impact	Negligible adverse impact	Minor adverse and positive impacts	Minor to moderate adverse impact	Similar to, but less adverse than alternative 5	Minor adverse impact
Wildlife viewing opportunities – percent change by 2006	42% increase is bison population over 1997; minor benefit compared to existing conditions	14% increase over alternative 1; minor to moderate benefit compared to alternative 1	14% increase over alternative 1; minor to moderate benefit compared to alternative 1	8% decrease over alternative 1; minor adverse impact compared to alternative 1	35% decrease over alternative 1; moderate to major adverse impact compared to alternative 1	1% higher than alternative 1; Same as alternative 1 through the year 2009, and similar to alternative 5 after 2010	12% decrease by 2006; 23% by 2011; minor to moderate adverse impact compared to alternative 1
Winter recreation; snowmobiling	No impact	Displacement of well over 50% of oversnow park visitors; major impact on individual in-park users; minor to moderate adverse impact overall	Possible minor to major impact if research indicates road closures needed	No impact	Major impact on some individual in-park snowmobile users; minor to moderate impact overall	Similar to alternative 2 for first 10 years; then similar to alternative 5 for 2-3 years	No impact
Hunting	No impact	No impact	75-85 bison hunting permits; minor to moderate benefit	35 bison hunting permits; minor benefit	No impact	No impact	15-25 bison hunting permits; minor benefit
IMPACTS ON LIVESTOCK OPERATIONS							
Cost of vaccination and testing	2% of yearly production costs; minor impact in the long term, but more apparent in years of low cattle prices	With removal of test-eligible cattle, no testing or vaccinating in SMAs; possibly continued testing and vaccinating in areas near SMAs	Similar to alternative 2 in the long term, but smaller SMAs and possible continued presence of test-eligible herds in western SMA	Same as alternative 1	Possibly less vaccination and testing; minor beneficial impact	First 12 years, same as alternative 1; final 3 years, same as alternative 5	Same as alternative 3 north of Yellowstone National Park; same as alternative 1 west of park
Operational changes to non-breeding cattle–individual ranchers	No impact	Possible conversion of cow-calf operations; moderate to major impact on a few individual ranchers	Fewer possible conversions than in alternative 2; moderate to major impact on a few individual ranchers	No impact	No impact	No impact	No impact

Topic	Alternative 1: No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7: Preferred Alternative
Modification of grazing on national forest allotments	No impact	Possible allotment modifications; moderate to major impact on a few ranchers using allotments now	Fewer possible modifications than in alternative 2; moderate to major impact on a few ranchers using allotments now	No impact	No impact	No impact	Short term, no impact; long-term, a few allotments on the north end may be modified; moderate to major impact on those users
Private land acquisition or easements	No impact	Possible buyouts or easements; major impact on public funds	Fewer possible buyouts or easements than in alternative 2; major impact on public funds	No impact	No impact	No impact	Same as alternative 3, but no acquisitions in West Yellowstone
Property damage by bison	Minor impact overall, but could be moderate to major for individuals affected	Short term, same as alternative 1; long term, reduced adverse impact	Short term, same as alternative 1; long-term, reduced adverse impact	Same as alternative 1	Minor impact overall, but could be a moderate to major benefit for individuals who might otherwise experience damage under interim plan	Same as alternative 1	Short term, same as alternative 1; long term, reduced adverse impact
Perception of risk	Risk exists; minor impact	Risk exists; moderate adverse impact	Until changes in operations or acquisitions occur, same as alternative 1; thereafter reduced risk	Same as alternative 1	Reduced risk, moderate beneficial impact	Slightly less, but similar to alternative 5; minor to moderate benefit	West Yellowstone, same as alternative 1; Reese Creek, reduced risk in long term
IMPACTS ON SOCIOECONOMICS – REGIONAL ECONOMY							
Impacts on regional economy from wildlife viewing	40-45% of regional economy ($500 million) dependent on tourism	Moderately beneficial impact from increased tourism; possible gain of up to $20 million	Similar to alternative 2	Similar to alternative 1 with hunting an additional source of local income	Major adverse impact from lost tourism; possible loss of up to $20 million	Similar to alternative 1 in most years, possibly more adverse during parkwide capture and slaughter	Similar to alternative 1, but more adverse over long term as population numbers are lower
Impacts on regional economy from snow-mobiling	No change in existing conditions; $30 million per winter	Loss of up to $656,000 to $2 million annually in West Yellowstone; negligible impact on overall economy, possible major adverse impacts on some individual businesses; possible minor positive impact in Gardiner	Same as alternative 1	Same as alternative 1	Loss of $1.8 million to $3.2 million annually during 3-4 years of parkwide capture, test, and slaughter	Same as alternative 2 during first 12 years, then similar to alternative 5 for 2-3 years of parkwide capture, test, and slaughter	Same as alternative 1
Impacts on regional economy from hunting	Bison hunting not allowed	Same as alternative 1	$33,000 annual expenditures	$15,380 annual expenditures	Same as alternative 1	Same as alternative 1	$10,890 per year increase from fees, expenditures
Impacts on regional economy from livestock sector	Livestock cash receipts for Gallatin and Park Counties comprise 5% of livestock cash receipts statewide	A few livestock operators may relocate their private and/or federal grazing operations to other locations; adverse impact offset by increased wildlife viewing related tourism	Same as alternative 2, but fewer livestock operators potentially displaced	Same as alternative 1	Aggressive brucellosis control may increase livestock use of area; negligible benefit	Similar to alternative 5, but less beneficial to livestock operators as brucellosis eliminated more slowly	Same as alternative 3, but without the possibility of displacements in the West Yellowstone area
IMPACTS ON SOCIOECONOMICS – MINORITY AND LOW-INCOME POPULATIONS							
Minority and low-income populations	$19,500 of bison meat donated on average per year; minor beneficial impact	Negligible adverse impact from loss of bison meat	Negligible adverse impact from loss of bison meat to hunters; negligible benefit from availability of live bison	$23,000 per year of bison meat received; value would be higher if some bison are donated live; minor benefit	$61,000 in meat available for 3-4 years, otherwise similar to alt 1; minor beneficial impact	$19,000 per year donated during phase 1; Similar to alt 5 during phase 2; minor beneficial impact	$26,000 per year of bison meat received; value would be higher if some bison are donated live; minor benefit
IMPACTS ON SOCIOECONOMICS – SOCIAL VALUES							
Social values	Minor to moderate impacts to those with humanitarian/ moralistic values; negligible impact to ranching values	Minor impact on traditional ranching lifestyles; relative positive impact on moral and humanitarian attitudes; possible major impacts on individual ranchers, tribes, those with moral/humanitarian values	Minor to moderate impacts on those opposed to hunting; negligible impacts on those with humanitarian/moral values; minor impact on ranching values	Overall minor to moderate; impacts on tribes minor; ranching similar to alternative 1	Those with humanitarian/moral values, tribes, some visitors experience major impact; ranchers negligible to minor benefits from eradication of brucellosis in bison	Similar to alternative 5 during phase 2 (parkwide capture, test, and slaughter), to alternative 1 during first 12 years	Minor to moderate adverse impact on humanitarian/moral values; minor to major impact on tribes; minor impact on traditional ranching lifestyle

Topic	Alternative 1: No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7: Preferred Alternative
IMPACTS ON SOCIOECONOMICS – NONMARKET VALUES							
Annual nonmarket values attributed to well-being of bison population	Negligible to minor beneficial impact	Major beneficial impact; $1.6 million to $22.9 million	Similar to or slightly less than alternative 2	Similar to alternative 1	Major adverse impact; $1.6 to $22.9 million opportunity cost	Same as alternative 1 until parkwide capture and slaughter, then same as alternative 5	Similar to alternative 1 in the short-term, but to alternative 5 in the long-term from decreased population size
Nonmarket values attributed to wildlife viewing	Negligible to minor beneficial impact	Impact estimate ranges from negligible benefit up to $9.8 million	Similar to or slightly less than alternative 2	Similar to alternative 1	Impact estimate ranges from adverse negligible loss up to $9.8 million	Same as alternative 1 until parkwide capture and slaughter, then same as alternative 5	Similar to alternative 1 in the short-term, but to alternative 5 in the long-term from decreased population size
Nonmarket values attributed to recreation or hunting	No impact	$2.5 to $7.6 million loss (winter recreation)	$19,000 gain from hunting	$11,000 gain from hunting	$6.9 to $8.0 million loss (recreation) during 3-4 years of park-wide capture and slaughter	$2.5 to $7.6 million loss (winter recreation) first 12 years; up to $17 million loss for remaining 3-4 years	Negligible loss to recreation; minor gain to hunting (estimated $11,000)
IMPACTS ON THREATENED, ENDANGERED, AND SENSITIVE SPECIES							
Peregrine falcon	No impact	No impact	No impact	No impact	No impact	No impact	No impact
Bald eagle	Potential human disturbance impacts reduced to negligible through avoidance mitigation	No impact	No impact	Same as alternative 1	Potential direct effect on wintering eagles from capture facility in Madison River area; major impact possible	Potential major adverse impact on one pair of nesting bald eagles from construction of a capture facility at Seven-Mile Bridge	Same as alternative 1
Analysis area grizzly bear – carrion supply	Slower than natural increase to maximum bison population level would have negligible impact	Quicker growth of bison population, largest range; moderate benefit compared to alternative 1 to bears by increasing carrion foraging	Minor benefit to bears compared to alternative 1 from increased growth rate, range of bison population	Same as alternative 1	Rapid decrease in bison numbers, reduction in carrion foraging opportunities for bears from range of bison population; moderate to major adverse impact	Same as alternative 1	Bison numbers less than alternative 1; bison numbers to be monitored in the park to ensure sufficient numbers to protect foraging opportunities resulting in a negligible impact
Park interior grizzly bear – carrion supply	Groomed roads now allow bison to leave park during severe winter; negligible impact on bear carrion supply	Closing groomed roads to snowmobiles may keep bison in interior; minor to moderate beneficial impact on bear carrion supply by increased winterkill	Same as alternative 1	Same as alternative 1	Rapid decrease in bison numbers, reduction in carrion foraging opportunities for bears from range of bison population; moderate to major adverse impact	Same as alternative 1	Same as alternative 1
Grizzly bear – human confrontations	Possibility of human/bear encounter and bear being shot increased by bison management actions; currently mitigated by removal of bison viscera, body parts after shooting	Fewer bison likely shot because of larger SMAs, more dispersed shooting; beneficial impact compared to alternative 1	Possibility of human/bear encounter and bears being shot increased by bison hunting; impact reduced to negligible through hunter education	Same as alternative 3	Same as alternative 1	Same as alternative 1	Same as alternative 3
Grizzly bear – bison management activities	Potential disturbance and displacement caused by hazing and shooting of bison; negligible impact; no or negligible impact from capture facilities, as bears are denning	Potential temporary disturbance and displacement caused by hazing and shooting of bison; negligible impact, as most occurs during denning period	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1
Gray wolves – human confrontation	No impact	No impact	Possibility of a human/wolf encounter and wolf being shot increased by bison hunting; impact reduced to negligible through hunter education	Same as alternative 3	No impact	No impact	Same as alternative 3

Topic	Alternative 1: No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7: Preferred Alternative
Gray wolves – bison management activities	Disturbance and displacement caused by hazing and shooting; short-term, negligible impact; no or negligible impact from capture facilities	Potential displacement of wolves that may inhabit the area in the future caused by shooting bison; negligible impact	Same as alternative 2	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1
Gray wolves – bison as prey and carrion	Negligible impact	Moderate benefit for wolves by increasing their opportunities to forage on carrion due to quickest growth of bison population and largest range	Similar to alternative 2, but negligible as range and growth rate of bison population would be less	Same as alternative 1	Smaller range and rapid decrease in bison population would reduce wolf foraging opportunities; moderate to major adverse impact	Same as alternative 1	Reduced size of bison herd over the long term would have a negligible impact on wolf foraging opportunities
Wolverine and lynx – changes in snowmobile grooming	Negligible impact	Potential shift in use to national forest caused by stopping road grooming for snowmobiles at west entrance; potential increase in packed snow routes, allowing predators to access prey now used by lynx; negligible adverse impact	Same as alternative 1	Negligible impact	Negligible impact	Negligible impact	Negligible impact
Trumpeter swan – nesting pair	No impact	No impact	No impact	No impact	No impact	Major adverse impact from Seven-Mile Bridge facility	No impact
IMPACTS ON OTHER WILDLIFE SPECIES							
Pronghorn antelope – habitat removal	Removal of >13 acres of critical winter habitat due to Stephens Creek facility; moderate to major adverse impact	Same as alternative 1 during phase 1, then moderate to major benefit from removal of facility at Reese Creek	Same as alternative 1 unless land acquired and capture facility moved north; if so, possible major benefit	Same as alternative 1	Removal of critical winter habitat caused by Stephens Creek and other facilities; moderate to major adverse impact	Same as alternative 5	Same as alternative 3
Elk, antelope, and other ungulates – capture operations	Disturbance and displacement caused by hazing, fences, and shooting; minor impact	Same as alternative 1 during phase 1, then minor benefit from removal of facility	Short term, same as alternative 1; long term, minor benefit from removal of Stephens Creek facility	Same as alternative 1	Minor impact caused by additional capture facilities	Same as alternative 5	Same as alternative 3
Elk, antelope, and other ungulates – acquisition of land	No impact	Moderate to major beneficial impact on pronghorn; minor benefit to other ungulates	Moderate to major beneficial impact on pronghorn; minor benefit to other ungulates	Same as alternative 1	No impact	No impact	Same as alternative 3
Predators and scavengers	Potential minor impact caused by hazing; negligible impact on carrion supply from removal of bison	No impact	Potential minor impact caused by hazing; no impact associated with changes in bison population relative to alternative 1	Same as alternative 1	Major decrease in prey/carrion; moderate adverse impact	Slight to moderate decrease in prey/carrion; minor adverse impact	Minor adverse impact from maintaining smaller bison population size over long term
Impacts associated with snowmobiling	Displacement, noise, habitat modification; degree of impact unknown, likely minor	Minor to moderate impact from snowmobile use displaced to national forest	Same as alternative 1	Same as alternative 1	Moderate adverse impacts during parkwide capture and slaughter from displacement due to road closures	Same as alternative 2 for first 12 years, then additive with alternative 5; moderate impacts likely	Same as alternative 1
IMPACTS ON HUMAN SAFETY							
Risk of bison management personnel or hunters contracting undulant fever	Negligible to minor impact	Negligible impact	Negligible to minor impact	Negligible to minor impact	Moderate impact (phase 1); negligible impact (phase 2)	Negligible to minor impact for first 12 years; moderate impact last 3 years	With mitigation, negligible to minor

Topic	Alternative 1: No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7: Preferred Alternative
IMPACTS ON CULTURAL RESOURCES							
Archeological resources	No additional impact	Potential disturbance from removal of capture facilities; minor impact	Potential disturbance from grading for capture or quarantine facilities; minor impact	Same as alternative 3	Same as alternative 3	Same as alternative 3	Same as alternative 3
Historic landscape	Capture facilities visually intrusive on landscape; negligible impact	Dismantling capture facilities, additional bison restores scene; beneficial impact	Dismantling capture facilities inside park, some increase in bison restores scene	Similar to alternative 3	Additional capture facilities not part of historic scene inside park; major short-term adverse impact	Same as alternative 5	Similar to alternative 3
IMPACTS ON VISUAL RESOURCES							
Presence of capture/quarantine facilities	Minor to moderate impact on natural vista	No impact	Minor to moderate impact from relocated facility; quarantine minor impact	Minor to moderate impact on natural vista; quarantine minor impact	Short-term moderate to major impact on natural vista	Short-term moderate to major impact on natural vista; major adverse impact from Seven Mile Bridge facility	Location of Horse Butte facility minor to moderate impact; otherwise similar to alternatives 3 and 4
Bison viewing	Potential increase in viewing opportunities from increase in bison population over time; minor impact on those seeking bison; minor to major impact for those opposed to increased bison population	Moderate benefit for those seeking bison due to moderate increase in bison population, compared to alternative 1; minor to major adverse impact for those opposed to increased bison population	Same as alternative 2	Same as alternative 1	Major adverse impact on viewing opportunities for those seeking bison due to major decrease in bison population, compared to alternative 1; minor to major benefit for those opposed to increased bison population	Moderate to major adverse impact on viewing opportunities for those seeking bison due to moderate to major decrease in bison population, compared to alternative 1; minor to major benefit for those opposed to increased bison population	Same as alternative 6
Bison management activities	Potential major visual impact caused by hazing, shooting and gutting	No impact	Potential major visual impact caused by hunting	Potential major visual impact caused by hazing, shooting, hunting, and gutting	Major visual impact from capture operations	Same as alternative 5	Similar to alternative 4
Winter scene	Current effect on scene from snowmobiles and other winter recreationists	Minor to major benefits for the park visual scene from displaced snowmobiles, minor to major adverse impacts on the scene on adjacent USFS lands	Same as alternative 1, unless research indicates closures; if so, same as alternative 2	Same as alternative 1	Same as alternative 2, except visitors able to access park would experience moderate to major impact from capture operations on winter scene	Same as alternative 2, except visitors able to access park would experience moderate to major impact from capture operations on winter scene 5	Same as alternative 1

AFFECTED ENVIRONMENT

The project, or analysis, area is a part of what is often described as the Greater Yellowstone Area, the largest and most nearly intact ecosystem in the contiguous United States (Greater Yellowstone Coordinating Committee 1991); see the Greater Yellowstone Area map). The portion of the Greater Yellowstone Area specifically subject to analysis includes those areas in Yellowstone National Park habitually occupied by bison (approximately 1.75 million acres), as well as adjacent federal, state, and private lands outside the park in southwestern Montana (parts of Park and Gallatin Counties) that have been periodically occupied by Yellowstone bison during the past 12 years (see the Study Area map).

The portion of the analysis area outside the park includes approximately 568,994 acres, of which about 97% is managed by Gallatin National Forest, 1% by state or local government, and 2% by private owners.

In all alternatives except alternative 5, the following would be designated special management areas (SMAs) on the Gallatin National Forest:

- Cabin Creek Recreation and Wildlife Management Area outside the park's western boundary
- Monument Mountain Unit of the Lee Metcalf Wilderness outside and adjacent to the park's northwestern boundary
- Horse Butte area near West Yellowstone
- Portions of the Absaroka-Beartooth Wilderness adjacent to the park's northern boundary, including the Hellroaring and Slough Creek drainages
- Gallatin National Forest land in the vicinity of the Eagle Creek/Bear Creek drainage adjacent to the northwestern portion of the park.

The Cabin Creek Recreation and Wildlife Management Area, Monument Mountain Unit of the Lee Metcalf Wilderness, and Horse Butte area lands are referred to collectively as the western SMA throughout this document, and are depicted on all alternative maps except alternative 5. In alternative 2, the boundary of the western SMA continues south from Hebgen Dam, and then follows the Montana-Idaho state line to the border of Yellowstone National Park.

In alternatives 2, 3, and 7, land in the Gardiner Valley, from the park's northern boundary to Yankee Jim Canyon, is either partially or wholly included in an SMA. In alternatives 3 and 7, land to the west of the Yellowstone River in this valley is referred to as the Reese Creek SMA in this document. In alternative 2, land on both sides of the river becomes part of an SMA.

The portion of the Cabin Creek Recreation and Wildlife Management area available to bison is approximately 37,000 acres in size, and is accessed by U.S. Highway 191 and U.S. Highway 287. It is primarily high elevation (8,200 feet to 10,600 feet) mixed forest and open meadow. The Cabin Creek area is managed for grizzly bear and big game, and allows recreation consistent with animal presence. Semiprimitive and nonmotorized recreation is allowed. The area is rarely used by bison, but may be occupied by a few bulls.

The Monument Mountain Unit of the Lee Metcalf Wilderness is 31,000 acres in size, and is also accessed by U.S. Highway 191 and U.S. Highway 287. It ranges in elevation from 7,400 feet to about 10,100 feet, and is mixed conifer forest and mountain meadows. Bison are most likely to use the lower elevations of the wilderness, and enter the area from the east on Bacon Rind Creek or from either of the roads leading into it. In most alternatives, bison leaving the Taylor Fork drainage and heading north past Buffalo Horn in the Gallatin Canyon would be shot by agencies (several cattle ranches lie to the north).

The Horse Butte area is approximately 24,000 acres in size and lies generally north of Highway 20 leading west from the town of West Yellowstone. It is also east of the south fork of the Madison River and Hebgen Lake. Lands north of Hebgen Lake up to and adjacent to the southern boundary of the Cabin Creek Recreation and Wildlife Management Area are part of the area described as the West Yellowstone or Horse Butte area in this environmental impact statement. Much of this area is open meadow mixed with conifer forest, and is lower in elevation than the Cabin Creek or Lee Metcalf portions of the western SMA.

The Absaroka-Beartooth Wilderness is high elevation land, and is more heavily forested than the Cabin Creek or Lee Metcalf areas. Bison typically enter this area from the south along the Slough Creek and Hellroaring Creek drainages. The hydrographic divide is the northern boundary of this SMA. Between 10 and 20 bison may use this area, primarily in the summer. The portion available to bison is about 270,000 acres.

The Eagle Creek/Bear Creek area, identified as an SMA for all alternatives except number 5, is approximately 23,000 acres in size and is located on the Gallatin National Forest, primarily on the benches about a half mile north and east of Gardiner, Montana. A network of roads and trails crisscross the area, but the major access is via Park County Road 15 (known locally as the Jardine Road), which goes to the town of Jardine.

There are significant elevational differences found across the breadth of the Eagle Creek/Bear Creek SMA, as well as the presence of several drainages. The elevation is 5,200 feet at the valley floor and 10,500 feet at the crest of the hydrographic divide. The SMA is bordered on the southwest by the Yellowstone River, and the northwest by the Little Trail Creek/Maiden Basin hydrographic divide. It is traversed by Bear Creek and Eagle Creek and their respective tributaries.

LANDSCAPE OF THE AREA

The landscape of the analysis area is characterized by steep, mountain ranges, most of which trend north and south. The Gallatin and Absaroka mountain ranges dominate the north-central portion of the area on the west and east sides of the Yellowstone River valley, respectively. West of Yellowstone Park, the Madison Range parallels the Gallatin Range.

The Continental Divide crosses Yellowstone National Park diagonally, from a few miles south of West Yellowstone, Montana, to the southeast corner of the park near the Thorofare region. North and east of the divide, numerous streams flow from the park area into the Missouri River drainage. Preeminent among these is the Yellowstone River, which heads just southeast of the park, then flows north and northwest through the park, then north into Montana and northeast across Montana to the North Dakota border, where it joins the Missouri River.

The Madison River, formed by the geothermally influenced waters of the Gibbon and Firehole rivers, flows west from the park, then north to Three Forks, Montana, where it meets the Jefferson, coming in from the west, and the Gallatin, which rises in the Gallatin Mountain Range in northwestern Yellowstone National Park. The three form the Missouri River.

The climate of the study area features long, cold winters, and short, cool summers. Mean monthly temperatures average 32.3°F. Weather conditions at Gardiner, Montana, are generally the mildest in the area. Between 75% and 85% of precipitation in the mountainous regions of Yellowstone National Park falls as snow. In the interior plateau regions of Yellowstone National Park, 35% to 55% of precipitation falls as rain (Despain 1987).

Bison in Yellowstone National Park.

VEGETATION

The region in and around Yellowstone has great variations in elevation, soils, and climate, and is something of a botanical crossroads, with at least seven "distinct floras" present, ranging from desert to alpine (Despain 1990; Glick et al. 1991). About 1,700 species of plants have been identified in the region, but most of the landscape is dominated by only a few species.

Approximately 60% of the federal lands in Greater Yellowstone is covered by forest, and the majority of that area, especially in the elevations between 7,500 feet and 9,000 feet, is dominated by lodgepole pine. Between 6,000 feet and 7,000 feet depending on conditions, grasslands and shrub steppes are the native vegetation communities in river valleys, floodplains, and terraces, though many plants' distributions have been changed by cultivation. Distinctive vegetative communities also occur on private land and lower elevations in riparian areas bordering both moving and still waters.

Lodgepole pine, in various stages of succession, is the primary tree species inside the park, covering about 1.4 million acres of park land. Englemann spruce and subalpine fir are most often found in moist areas, and form the "climax" forest in areas underlain by the richer andesite soils. Whitebark pine is usually the dominant tree species at elevations above 8,400 feet. Douglas-fir and aspen occur at elevations ranging from 6,000 to 7,600 feet. These communities are chiefly associated with the Yellowstone, Lamar, and Madison River drainages. A few other species, such as cottonwood, found along stream corridors, and limber pine and Rocky Mountain juniper, found at lower elevations primarily in the northern end of the park, are intermittent species comprising a very small portion of the Yellowstone landscape.

Nonforested areas consist of shrublands, grasslands, subalpine or other wet meadows, and alpine tundra. Several species of sagebrush, rabbitbrush, yarrow, sulphur buckwheat, Idaho fescue, bluebunch wheatgrass, and junegrass are among the species that dominate shrubland communities. Grasslands are typically represented by bluebunch wheatgrass, Sandberg's bluegrass, bearded wheatgrass, Hood's phlox, rosy pussy-toes, and others. In subalpine or other wet meadows, willows, cinquefoil, American bistort, tufted hairgrass, alpine timothy, and various sedges are common. A wide variety of

low-growing grasses and forbs are found in alpine tundra.

The Stephens Creek area is located in the Yellowstone River valley at the lowest elevations within park boundaries, ranging from 5,000 to 6,000 feet. Annual precipitation averages from 8 to 12 inches. Vegetation is best described as bunchgrass steppe or shrub steppe communities. Grasses in these areas include Idaho fescue, junegrass, and occasionally bluebunch wheatgrass. About 570 acres of abandoned agricultural fields, added to the park in 1932, are present in this area. Prominent vegetation on these lands is crested wheatgrass.

In Eagle Creek/Bear Creek, precipitation is about 10 to 12 inches a year, and the vegetation is a mosaic of dry sagebrush shrublands and dry grasslands such as bluebunch wheatgrass and Idaho fescue. As the elevation increases, the average annual precipitation increases as well. The additional moisture allows for the presence of forests.

Most of the West Yellowstone area of the western SMA is found on a 7,000-foot plateau, which includes the obsidian flats, found in the area in the east and central portion of the SMA. This part of the SMA supports primarily lodgepole pine. At one point a rhyolite monolith (Horse Butte) rises about 300 feet in elevation from the center of the SMA. The monolith supports an *Abies lasiocarpa/Calamagrostis rubesens* habitat type on northerly exposures, grasses such as Idaho fescue and Ross's sedge on southern exposures, and distinctive aspen groves on the small area of flat terrain.

There is a wide variety of vegetation within the Cabin Creek Recreation and Wildlife Management Area and the adjoining Monument Mountain Unit of the Lee Metcalf Wilderness. This variety is associated with elevations that range from 7,200 to 10,600 feet (Sage Peak) and numerous soil types. The vegetation present within the Cabin Creek Area and adjoining Monument Mountain Unit is associated with either forested, mountain meadow, alpine meadow, or rock rubble habitats.

Approximately 65% of the land area is forested. These forested areas are dominated by mixed conifer stands of lodgepole pine, Englemann spruce, and subalpine fir. Whitebark pine is generally the dominant tree species above 8,400 feet. Aspen is not a significant component of the forested habitats. Douglas-fir exists at the lower elevations on southern aspects. The grass/forb associations within the forested areas consist of pine grass, sedge, trisetum, huckleberry, and arnica.

Mountain meadows are interspersed throughout the area and comprise about 20% of the area. Some of these meadows are up to 600 acres and contain clumps or isolated patches of subalpine fir/spruce and/or clumps of whitebark pine, subalpine fir/spruce. The grass component consists of grasses such as meadow barley, sedge, tufted hair-grass, alpine timothy, while forb components consist of plants such as meadowrue, carrotleaf, paintbrush, aster, potentilla, mountain dandelion, and geranium. The wetter mountain meadows have shrub components consisting of willow, and some of the drier meadows have a sagebrush component.

Set apart from the mountain meadows by elevation are the alpine meadows. These non-forested areas comprise 10% of the area and are generally above 9,400 feet where harsh climate limits growth. Trees such as alpine fir, spruce, and whitebark pine are stunted, deformed, and isolated. Grass plants include Idaho fescue, tufted hairgrass, and sedge. Forbs include mountain dandelion, lupine, and clover. Shrubs include purple mountain heath.

Rock rubble or rubble land make up approximately 5% of the unit. Moss and lichen are found in these high elevation areas, but there are also isolated areas of stunted whitebark pine. Purple mountain heath is also found in some of the rock crevices.

The portion of the Absaroka-Beartooth Wilderness bordering Yellowstone National Park to the north is characterized by a series of deep, parallel drainages. Hellroaring, Buffalo Fork, and Slough Creek are the major drainages.

They begin at the Boulder Divide 10 to 15 miles north of the park boundary and flow in a north-south direction. The area was heavily impacted by fires in 1988. The upper reaches that did not burn are densely forested. Several large willow communities and wet meadows are present at wider parts of the valleys. After the creeks flow into Yellowstone Park, sage/grasslands are prevalent. High ridges with whitebark pine forests, exposed bedrock, and alpine meadows separate the drainages. Snow conditions preclude access to most ungulates during most of the year. Bison are found in this Absaroka-Beartooth Wilderness rather infrequently, but there is suitable summer and fall habitat for this species.

WETLANDS

Only general mapping of wetland resources has occurred in the affected area of Yellowstone National Park and the Gallatin National Forest. According to these maps, wet forest habitat dominated by subalpine fir and Englemann spruce covers about 8% of the park. The forest floor is dominated by a variety of wet-site species including horsetails, bluejoint reedgrass, trapper's tea, twisted stalk, arrowleaf groundsel, and a variety of mosses.

Shrubby riparian habitats are usually dominated by willows and sedges. They are most often distributed along streams and near seeps. Grassland riparian habitats are most often sedge marshes or bogs. Their distribution is usually associated with standing water throughout the growing season.

Prior to placement of capture or quarantine facilities (if they are part of the selected alternative), sites would be surveyed for wetland resources and facilities modified or moved to avoid them.

ACCESS

The region is served by a wide variety of federal, state, and local road systems. Two Montana travel corridors approach Yellowstone National Park: U.S. Highway 89 from the north and U.S. Highway 191 on the west. An all-season gravel-surfaced county road parallels about 7 miles of U.S. Highway 89 north and west of Gardiner. About 4.5 miles of this road are in the park. The only paved roads in Yellowstone National Park open to conventional vehicles year-round are from the north entrance at Gardiner, Montana, to Cooke City, Montana, outside the northeast entrance, and U.S. Highway 191 along the northwest boundary of the park. Except for this road, winter travel in Yellowstone National Park is limited to oversnow vehicles (on groomed roads only) and nonmotorized modes of transportation.

A number of county and USFS roads provide access to public and private land both north and west of the park. Winter travel on most of the USFS roads is limited to oversnow vehicles.

HUMAN POPULATION

In 1990 the combined population of Park and Gallatin Counties, Montana, bordering Yellowstone National Park to the north and west, respectively, was 65,000 people. Less than 5% of that population, perhaps 2,500 people, reside within the analysis area.

Other residents in the study area are employees in Yellowstone National Park. At the height of the summer season in the park, there are approximately 3,930 employees; 3,200 are concession employees, and 730 work for the National Park Service. During the winter months there are 700 employees; 450 are concession employees, and 250 are NPS employees.

Gallatin and Park Counties include 38% and 48% federal land, respectively. In the study area, more than 90% of the land is federal.

In 1996, 5.8 million recreational visits were recorded in the area (3.0 million in Yellowstone National Park and 2.8 million in Gallatin National Forest). Recreational visits are expected to increase between 16% and 38% by the year 2003.

Cattle operations on public and private lands are located north and northwest of the towns of West Yellowstone and Gardiner. Near West Yellowstone, there are five cattle allotments on public land and a few private holdings in the Hebgen Lake area (see Bison Winter Movements map). Northwest of Gardiner, several operators run livestock on public allotments on the Gallatin National Forest, and at least one large operator (and several smaller) on private lands (see "Livestock Operations" section). In some alternatives, the boundary on the west side extends as far north as Buffalo Horn Creek. Extensive private land holdings lie north of this boundary and out of the analysis area. Cattle operations in the West Yellowstone area and most of those in the Gardiner area are predominantly summer only. Cattle are maintained on a year-round basis on the privately owned Royal Teton Ranch adjacent to the park's Reese Creek border.

The terms "bison" and "buffalo" are both acceptable names for the animal scientifically classified as *Bison bison*. The genus *Bison* crossed the Bering Strait from Eurasia sometime during the late Pleistocene Era. Studies of the paleontology and history of the area indicate bison have inhabited the Greater Yellowstone Area since prehistoric times (NPS, Meagher 1973; Schullery and Whittlesey 1992).


Bull bison fighting.

BEHAVIOR AND SOCIAL INTERACTIONS

Bison are driven by instincts for survival and mating. Distinct behaviors may vary with age and sex. Behaviors are also influenced by habitat and environmental conditions, which affect the availability and access to forage. Land management decisions by agencies may affect behavior.

Much of bison behavior is based on the differential groupings of animals. Cow-calf herds, for example, are most pronounced in the spring, during calving. This herding instinct may be motivated primarily to protect calves against predators because adult bison have few natural predators. The social bonds formed by cow-calf herds are strong and usually are broken only by severe environmental conditions.

Young bulls (up to 6 years of age) or older bulls (more than 10 years of age) exhibit different social behaviors. Young bulls often separate from the cow-calf herds after the rut to form small fraternal groups. They will generally coexist peacefully with each other for most of the year, but as the rut approaches, increased competition and fights for dominance occur. Older bulls are often found as scattered individuals that may move long distances. These bulls are often the least tolerant of any other animals, including humans.

Bison are quite sociable, as long as the habitat allows them to aggregate. Large herds of bison of mixed sex and age classes may congregate on range with suitable forage, especially during the rut. In Yellowstone, Hayden Valley, Pelican Valley, and Lamar Valley are suitable habitats for seasonally large bison herds. The National Park Service is currently initiating research to study the ecological carrying capacity in the park. However, herds of any size will seldom spend much time in any one place. Because individual bison tend to live on large quantities of low-quality forage, bison herds are constantly on the move, feeding from one site to the next. They will seek out higher-quality forage, but those sources are generally available only on a short-term, seasonal basis.

Despite their size and seemingly slow-moving habits, bison are surprisingly agile and quick. They have great stamina to travel long distances. Bison will usually choose the most energy-efficient travel route, over flat, open terrain, although they may sometimes select courses that are exceptionally steep, rough, or otherwise inhospitable. In deep snow, they commonly travel in single file, with alternating leaders, to reduce energy expenditures. Currently, a number of routes in the park are groomed for snowmobiling, and the road from Mammoth to Cooke City is plowed. Bison use plowed roads and compacted or groomed trails in the winter, and this may reduce their energy expenditure (Aune 1981; Aune, pers. comm.).

In the winter Yellowstone National Park is the most severe North American habitat supporting a viable population of free-ranging bison (Meagher 1971). Canada may have colder temperatures, but

the accumulation of snow on the Yellowstone Plateau makes it more stressful for bison and affects their behavior. Bison, however, are well adapted to this environment. Using their massive heads, supported by powerful neck and shoulder muscles, bison have the ability to displace snow to access forage in areas unavailable to other ungulates.

When conditions such as very deep or heavily crusted snow limit availability or access to forage, a breakdown in social bonds may occur. Smaller groups of bison split from the large herds and search for isolated habitats, such as Yellowstone's numerous geyser basins and scattered meadows, which individually support only limited numbers of bison.

Bison learn quickly to avoid actions such as hazing or hunting as easily as they learn to use groomed roads or trails for travel (Meagher 1989a).

HABITAT AND FORAGE

Bison are most often seen grazing in open meadows and along river valleys (NPS, Meagher 1973). Suitable bison habitat outside Yellowstone National Park would likely include lower elevation winter range along major drainages, and much of it is currently under private ownership. Willow thickets and sage steppe, the habitat occupied by white-tailed deer or pronghorn, are not preferred by the bison. Thermal areas are important winter feeding grounds due to the easy accessibility of plants growing on the warmer soil. The heat from warm ground and thermal features also reduces the amount of energy bison must expend to keep warm in winter.

Sedges, and to a lesser extent grasses, constitute the preferred diet of Yellowstone bison. In winter, 99% of their diet is grasses and sedges, with browse being the remaining 1%. In summer they consume slightly more forbs (NPS, Meagher 1973).

BREEDING, CALVING, AND SEX-AND-AGE CLASSES

The rut (breeding activity) season occurs from about mid-July to mid-August. Female bison rarely breed as 1.5-year-olds. Approximately one-quarter of the 2.5-year-olds breed (NPS, Meagher 1973). The majority of females attain sexual maturity by 3.5 years of age. Males are sexually mature at approximately the same time as females, but more dominant older bulls usually will not allow younger bulls to become part of the active breeding population until they are at least six years of age.

Typically, bison are born in the spring. Calving begins by mid-April, but most births occur during May. There are always a few out-of-season births. Single births are the rule; reports of twins are extremely rare. From 1990 to 1992, researchers found 52.6% of mature females produced calves on the northern range compared to 42.6% for the Mary Mountain area (Kirkpatrick et al. 1996). They also found pregnancy rates, estimated by urinary or fecal steroid analysis, of 51.6% for the northern range and 39.8% for the Mary Mountain area. Comparison with observed calving rates suggest that neonatal loss was not significant for bison in Yellowstone National Park. However, the pregnancy rate determined by necropsy of hunter-killed bison from the northern range during the 1988–89 winter was 75% (Pac and Frey 1991). The pregnancy rate, determined by necropsy of animals killed during management actions, for northern range bison during the 1930s and 1940s averaged 80% (range 65% to 95%, N=5) and from 1964 to 1966 was 52% for the entire adult female population (NPS, Meagher 1973). At low bison population numbers, little calfhood mortality was found, although subadult mortality (from calf to 2.5 year old) was estimated at 50% (NPS, Meagher 1973).

Sex ratios of bison in Yellowstone favors males over females (NPS, Meagher 1973; Pac and Frey 1991; Meyer and Meagher 1995). At low bison population numbers, a sex ratio of 56% males to 44% females was reported (NPS, Meagher 1973). Data from 1988 to 1989 showed fetal sex ratios favored females over males, but the sex ratio of

harvested bison was 57% male and 43% female (Pac and Frey 1991).

MORTALITY

Except for human management removals, winterkill is the main cause of mortality for bison in Yellowstone. Winterkill results from the combined effects of climatic stress, low forage availability, and declining physiological condition of individual animals. Bison expend most of their body fat in early to mid winter. As winter progresses, some bison cannot acquire enough of the nutrients needed to survive the remainder of the season. The old, sick, and young generally are the first to die of winterkill.

In the harsh Yellowstone climate, relatively few members of the population reach "old age," which probably begins at 12 to 15 years of age (Fuller 1959). Very rarely will a wild Yellowstone bison reach the age of 20.

Predation is not a significant cause of death among bison in Yellowstone. Historically, wolves may have hunted bison, although they would probably have had a limited effect because of the availability of alternate prey, such as elk and deer (Boyce and Gaillard 1992).

HISTORY OF BISON IN YELLOWSTONE NATIONAL PARK

In 1902, 23 bison were counted in the native Yellowstone herd. Due to subsequent protection from poaching, the number of wild bison steadily increased. Wild bison primarily used the Mirror Plateau and upper Lamar River area in summer, and primarily wintered in the Pelican Valley. Bison from captive herds were introduced in 1902 and held in enclosures, first at Mammoth and then in 1907 moved to facilities at Lamar (NPS, Meagher 1973). Between 1915 and 1920, intermingling of the introduced and wild animals began, and after about 1921 little or no effort was made to keep the two populations separate. By 1929 the total number of bison wintering in the Lamar area was more than 1,000 (see table 13).

Beginning in the 1930s, the National Park Service reduced bison numbers wintering in Lamar (NPS, Meagher 1973). Some of these bison were used to establish herds in the Hayden Valley and Firehole River areas. By 1952 management reductions lowered the number of bison in Lamar to 143 individuals. In January 1954 an aerial count of all primary wintering valleys indicated the bison population in the park was 1,477. Subsequent reductions conducted on the northern range (Lamar), Mary Mountain (Madison and Firehole Rivers and Hayden Valley), and Pelican Valley herds lowered the population of bison in the park to 397 individuals by 1967 (NPS, Meagher 1973). Beginning in 1967, manipulative management of bison in the park ceased. Under minimal management, the bison population increased to about 2,100 in the 1984–85 winter (see table 13).

Management actions from 1902 through 1968 removed an average of 94 bison each year (range 0–407) from the Yellowstone population (see table 13). Those removals occurred primarily within the park. During the period 1968 through 1996, management actions removed an average of 72 bison per year (range 0–569). Almost all of these removals occurred after 1984, and with the exception of one adult cow, all of these removals occurred outside of the park. Despite natural mortality and management removals during 1984 to 1996, bison numbers increased an average of 5.1% per year peaking at approximately 4,000 bison in 1994 and declining to approximately 3,500 in the early 1996–97 winter.

In 1996–97, severe winter conditions and other factors such as large herd numbers resulted in a major movement of bison outside the national park and management removals totaled 1,084 (32% of the early winter population). About 300–400 bison died as a result of winterkill. A July aerial survey of the total bison population indicated approximately 2,000 bison survived to spring 1997 (Meagher, unpub. data).

TABLE 13: HISTORIC BISON POPULATION COUNTS AND REMOVALS FROM 1901–02 TO 1996–97

Winter of Year	Total Bison Counted	Total Bison Removed	Winter of Year	Total Bison Counted	Total Bison Removed
1901-02	44	0	1931-32	nc	nc
1902-03	47	1	1932-33	nc	nc
1903-04	51	7	1934-35	nc	nc
1904-05	74	0	1935-36	847	109
1905-06	nc	nc	1936-37	674	17
1906-07	84	2	1937-38	755	25
1907-08	95	1	1938-39	811	67
1908-09	118	5	1939-40	868	3
1909-10	149	3	1940-41	809	213
1910-11	168	2	1941-42	869	202
1911-12	192	28	1942-43	964	11
1912-13	215	8	1943-44	747	407
1913-14	nc	nc	1944-45	932	nc
1914-15	270	4	1945-46	791	238
1915-16	348	18	1946-47	nc	nc
1916-17	397	11	1947-48	960	237
1917-18	nc	nc	1948-49	1,126	nc
1918-19	504	46	1949-50	1,094	228
1919-20	501	17	1950-51	nc	nc
1920-21	602	7	1951-52	976	250
1921-22	647	56	1952-53	nc	nc
1922-23	748	14	1953-54	1,477	139
1923-24	nc	nc	1954-55	1,350*	288
1924-25	830	109	1955-56	1,258	373
1925-26	931	23	1956-57	543	273
1926-27	1,008	41	1957-58	nc	12
1927-28	1,057	58	1958-59	800*	44
1928-29	1,109	106	1959-60	800*	nc
1929-30	1,124	132	1960-61	869	nc

Winter of Year	Total Bison Counted	Total Bison Removed	Winter of Year	Total Bison Counted	Total Bison Removed
1961-62	975*	148	1979-80	1,803	nc**
1962-63	819*	370	1980-81	2,396	nc**
1963-64	821*	6	1981-82	2,239	0
1964-65	388	392[a]	1982-83	2,160	0
1965-66	226	54	1983-84	2,229	0
1966-67	397	3	1984-85	2,114	88
1967-68	418	4	1985-86	2,291	57
1968-69	556	0	1986-87	2,433	6
1969-70	592	0	1987-88	2,644	35
1970-71	565	0	1988-89	3,159	569
1971-72	713	0	1989-90	2,606	4
1972-73	837	0	1990-91	3,178	14
1973-74	873	0	1991-92	3,426	271
1974-75	1,068	0	1992-93	3,304	79
1975-76	1,125	8	1993-94	3,551	5
1976-77	1,252	nc**	1994-95	3,956	427
1977-78	1,626	nc**	1995-96	3,398	433
1978-79	1,727	nc**	1996-97	3,436	1,084

SOURCE: NPS, Meagher 1973; Meagher, unpub. data; Montana Department of Fish, Wildlife and Parks, Montana Department of Livestock, and National Park Service, unpub. data).

NOTE: Sources of removals include culling from the semidomestic Lamar Ranch, hunting and agency shooting, and capture and slaughter.

nc = not counted or information unavailable

* Estimates, rather than actual counts.

** During 1976–81, a few bulls were removed.

a. Includes 38 from natural mortality.

ECOLOGICAL ROLE OF BISON

Bison play an important role in Yellowstone's ecosystem. They are the largest ungulate in the park, and consume huge quantities of grasses and sedges. Bison do not play the same ecological role in the park today that they did prior to settlement. That role may be different than prior to settlement because the park herd has been isolated.

There is some indication that grazing by both bison and elk can increase the productivity and stability of grassland systems, and enhance the nutrient content of grazed plants (Frank and McNaughton 1993; Singer 1995; Wallace 1996). Bison may contribute to new plant growth by distributing seeds, breaking up soil surfaces with their hooves and wallows, and fertilizing by recycling nutrients through their waste products.

Large numbers of bison can physically alter environments. Bison rub trees and saplings, debarking and sometimes killing them (NPS, Meagher 1973). This activity, over time and in some places, may benefit some insects and bird species (such as woodpeckers and cavity-nesting birds). Other species (such as Steller's jay) could be affected by loss of mature trees. It has been suggested that tree rubbing and debarking by bison may impede or even prevent forest invasion of open grasslands (NPS, Meagher 1973; J. Shaw, pers. comm. 1997).

Grazing may also maintain open grassland communities by preventing accumulation of dead grass litter that would otherwise suppress growth of grasses (T. Baumeister, pers. comm. 1997). These physical impacts, in combination with the previously mentioned stimulation of productivity in grazed areas, are likely to help maintain open grasslands that are important to many other species.

Historically, prairie dog distribution in the U.S. overlapped completely with bison distribution (J. Shaw, pers. comm. 1997). It is likely that burrowing rodents benefit from disturbances created by bison trampling and wallowing. Trampled areas and wallows, however, may also provide opportunities for invasion by nonnative and exotic vegetation, and may contribute to soil and streambank erosion.

Bison are not a significant prey for predatory animals. However, their carcasses are scavenged by many species of mammals, birds, insects, and other agents of decomposition.

BRUCELLA ABORTUS IN YELLOWSTONE BISON

Surveys to detect *Brucella abortus* seroprevalence rates in the Yellowstone bison population have been conducted during several periods since brucellosis was first discovered in Yellowstone bison in 1917. Most surveys for brucellosis have relied on serological tests that detect antibodies to the *B. abortus* bacteria, rather than presence of the bacteria itself. Historical surveys have reported seroprevalence rates of 53% (Rush 1932), 54%–74% (Tunnicliff and Marsh 1935), and 28%–59% (NPS, Meagher 1973). For the latter survey, conducted in 1964–65, a weighted average of brucellosis seroprevalence for bison from three wintering areas was 38%. All of the above seroprevalence rates were from bison sampled during NPS management actions within Yellowstone National Park, directed at maintaining bison population objectives through either roundup and slaughter or shooting of bison.

More recently, bison killed during control hunts and management actions (shooting and capture/test/slaughter operations) at or near the Yellowstone National Park boundary have been sampled opportunistically for seroprevalence. Pac and Frey (1991) reported a seroprevalence rate of 54% among 484 bison sampled in 1988–89. Of 240 bison tested in 1990–91, 45.4% were classed as seropositive (Aune and Schladweiler 1993). Between 1985 and 1992 a total of 904 bison were serologically tested for *B. abortus* antibodies. Of that sample 49.2% were classed as seropositive, and 50.8% were seronegative (Aune and Schladweiler 1993). During the winter of 1996–97, 246 bison were serologically tested at the Stephens Creek capture facility in Yellowstone National Park. Ninety-seven (39%) of those tested

were found to be seropositive, and 149 (61%) were seronegative (NPS, unpub. data).

The serological tests used on bison in Yellowstone National Park were originally developed for use in cattle, in which the relationship between seroprevalence and presence of the bacteria is highly correlated (Manthei and Deyoe 1970). In cattle, *B. abortus* has been isolated (cultured) from 86%–90% of seropositive animals (Lambert et al. 1960; Herr, Roux, and Pieterson 1982; Manthei and Deyoe 1970). There is some evidence, however, that the relationship between seroprevalence and actual infection is not highly correlated in bison (Meyer and Meagher 1995a). The precise relationship between serological tests and presence of *B. abortus* bacteria in bison is not well understood at this time. Preliminary evidence, however, indicated *B. abortus* isolations from 50% (5 of 10) of seropositive female bison (Rhyan et al.1997). Research is currently underway to determine this relationship more precisely (Roffe et al. 1997). Most of the bison shot and slaughtered during the winter of 1996–97 were tested for seroprevalence. Specimens for *B. abortus* culture were collected from some of these bison, but the results are not yet available.

OVERALL VISITOR USE AND EXPERIENCE

United States citizens and people from all over the world spend more than 9 million visitor days of recreation in developed sites of the Yellowstone area each year. Though the draw of people worldwide to Yellowstone National Park is obvious, the less visible national forests and state-managed lands and resources near the park also offer an abundance and diversity of recreational opportunities. In the national parks, more than 95% of all recreation takes place at developed sites. In national forests, developed sites account for only about 25% of recreational use, and the rest is dispersed. Federal, state, and county public recreation sites number about 460, including campgrounds, picnic areas, trailheads, interpretive sites, and boat-launching facilities (Greater Yellowstone Coordinating Committee 1987).

Bison herd at Yellowstone National Park.

Yellowstone National Park

Recreational visitation to Yellowstone National Park has grown by more than 25% in the last 14 years, from 2,404,862 in 1982 to 3,012,171 in 1996. As is common in most other western national parks, visitor use in Yellowstone is concentrated in the summer months, with 66% of the visitation in June, July, and August. The potential future recreational use of Yellowstone has been estimated, based on recreational use during the last 10 years. By the year 2003, estimated visitation is expected to range from 3.6 million to 4.3 million visitors per year (NPS 1994).

In the park, visitor use patterns are an image of entrance traffic. The west entrance to the park accounts for 34% of the vehicles entering in 1992, with the north and northeast entrances accounting for 14% and 6%, respectively, of the traffic (BRW 1994). Peak season average daily traffic on the west entrance road is 6,060 vehicles, while on the northeast entrance road, peak average daily traffic is 3040 vehicles (using 1992 figures). On the north entrance road between Gardiner and Mammoth, the peak average daily traffic number is 3,160 (BRW 1994). In 1993 the National Park Service began counting traffic through the park on U.S. Highway 191 as nonrecreational visitors (in prior years, these visitors were uncounted). In that year, 893,000 nonrecreational visitors were counted on U.S. Highway 191.

Visitor use in the park is concentrated in the major developed areas, such as Old Faithful, Canyon, Lake, and Mammoth Hot Springs. In 1990, 57% of summer visitors reported visiting the Mammoth Hot Springs area during their visit to the park (Littlejohn, Dolson, and Machlis 1990). Old Faithful is the most popular developed area in the park; 84% of 1990 visitors stopped at the Old Faithful area.

Visitor accommodations are also concentrated in the developed areas. In the parts of the park that would be affected most by bison management alternatives, the Mammoth Hot Springs area has 223 hotel rooms and cabins available for visitors, and 85 campsites in the NPS-managed campground, while the Tower-Roosevelt area has 80 cabins and a 32-site campground (out of a total of 2,181 motel rooms and cabins and 2,211 campsites, parkwide).

The nearby states of Wyoming, Montana, Utah, and Idaho accounted for 25% of all Yellowstone

visitors in 1990. These four states have a combined population of nearly 4 million, or just 1.5% of the United States population. Nearly one-half of the visitors are making their first trip to Yellowstone, and one-third are making a second, third, or fourth trip. Seven percent of the park's visitors were from outside the United States (primarily Canada and Germany).

Backcountry use accounts for about 5% of park visitation. Day use of backcountry areas is not recorded, but 44,000 visitor use nights by backcountry users were counted in 1993 (NPS 1994). In the northern and western portions of the park backcountry campsite use varied from an average of 25 person-use nights to 199 person-use nights for the 1986 through 1992 period. The most used campsite had an average of 756 person-use nights.

Stephens Creek Area. The Stephens Creek area (which is now used for a capture facility) of the park has few visitor-related facilities, and no statistics are kept for use of the area. The abandoned railroad bed has been designated as a mountain bicycling trail, and the county road provides access for visitors wishing to view wildlife (such as pronghorn) on the Stephens Creek flats. Some cross-country walking and horseback riding also occurs in the area. Recreational rafting, canoeing, and kayaking of the Yellowstone River downstream of Gardiner, which parallels the Stephens Creek area, is popular during the summer months, as is fishing on this segment of river. Trails from the county road lead to the river for fishing access.

Gallatin National Forest

Gallatin National Forest provided a total of 2,798,000 recreation visitor days in 1992 or nearly 4 million recreation visits. In 1992 recreational use in developed sites accounted for 27% of the total recreation visitor days in the national forest. Hunting accounted for 7% of the recreation days and nonconsumptive wildlife use was 1% of the recreation days. The remaining use is dispersed/wilderness use (Gallatin National Forest 1992).

Horse Butte Area. During the spring, summer, and fall, all of the Horse Butte area included in the SMA is designated as a day-use area. Overnight camping is restricted to the two developed campgrounds, at Baker's Hole and Rainbow Point. Camping at these two sites begins in late May and lasts through mid-September. Rainbow Point has 85 units, with only hard-sided campers allowed, while Baker's Hole has 72 units.

During the fall months, October and November, waterfowl hunters use the Madison River, Madison Arm, Horse Butte Peninsula, and southern shorelines of the Grayling Arm. Big-game hunting for elk, moose, and deer occurs throughout the SMA in September, October, and November (see discussion on hunting below).

Along the south shore of the Madison Arm are 40 private recreational residences. In addition, two recreational residences are on Rainbow Point, and three are at Baker's Hole. These residences are occupied throughout the summer season with some incidental use on weekends and holidays in the fall and winter.

Located midway along the south shore of the Madison Arm is the private Madison Arm Resort, which offers camping and a marina. The resort is open from Memorial Day through the end of September.

Bear Creek/Eagle Creek Area. The Bear Creek/Eagle Creek area serves as a major wintering area for big-game and is important both to horn hunters in the spring and to big-game hunters in the fall and winter. The hunting season runs from mid-October to mid-February in the area.

Fall hunters heavily use the campgrounds in the Bear Creek/Eagle Creek region, as well as the dispersed camping opportunities available throughout the area. The trailhead at Little Trail Creek also receives heavy use during both the fall and winter hunts. The Bear Creek and Palmer Mountain trailheads are located in this district, and they too receive a significant amount of use, especially by outfitters and others

during the backcountry hunting season (September 15–November). This area is especially popular and well known for elk hunting.

Summer activities include hiking, mountain biking, hang gliding, and camping at the Eagle Creek, Timber Camp, and Bear Creek campgrounds. Eagle Creek campground has 16 units, and Bear Creek and Timber Camp are dispersed camping. Eagle Creek is open year-round, while Timber Camp and Bear Creek campgrounds are open June 15 through October 31. Fees began to be charged as of 1997 at the Eagle Creek campground, so reliable records of use are not available.

WILDLIFE AND BISON VIEWING

When Yellowstone National Park was set aside in 1872 as the world's first national park, the "wonders of the Yellowstone" were the primary motivation — spectacular geysers, colorful hot pools, and the Grand Canyon of the Yellowstone (Meagher 1974). However, it is clear that in modern times, wildlife viewing is the primary activity for many visitors who come to Yellowstone National Park. In 1989 visitors who stayed in the park more than one day reported that their activities included viewing wildlife (93%), seeing thermal features (85%), photography (83%), walking for pleasure (75%), and visiting visitor centers (73%) (Littlejohn, Dolson, and Machlis 1990). Similarly surveys of park visitors during August-September 1990 and June 1991 found that wildlife observation was the single-most important activity for Yellowstone National Park visitors with 94% of respondents participating (Duffield 1992). This exceeds participation for geyser viewing (87%), bird watching (48%), hiking (29%), camping (19%), fishing (13%), and boating (3%). The relative importance of wildlife viewing is further revealed by the surprisingly high share of respondents reporting wildlife photography as an activity (73%).

The August-September 1990 survey also asked participants to rank the top 10 mammals and birds they hoped to see on their trip from a list of 21 animals (see table 14). Bison were ranked eighth in this list, with a ranking between eagles and wolves. Bison herds are commonly seen along three of the park's road segments: in the Lower Geyser Basin between Madison Junction and Old Faithful; in Hayden Valley between Lake and Canyon; and in the Lamar Valley

Bull elk.

between Tower Junction and the northeast entrance. Individuals and small groups can often be seen along all road segments. Because 75% of Yellowstone visitors enter the park through one gate and exit via another, most visitors pass through one of these areas. The major, observable effect of bison on existing visitor travel is traffic jams created when visitors slow or stop to watch herds of bison cross park roads. Traffic jams several miles long and up to several hours in duration have been observed in mid-summer in Hayden Valley.

Wildlife viewing is a primary activity in Yellowstone National Park and the adjacent national forests, and significant changes in wildlife populations can be expected to affect park visitation levels and total visitor spending in the regional economy. For example, visitor surveys conducted for the environmental impact statement concerning recovery of wolves in Yellowstone National Park (USFWS 1994) indicated that, other things equal, the opportunity to see or hear wolves in Yellowstone National Park could lead to an approximate 5% increase in visitation for nonresident visitors. This would amount to about $20 million per year in increased tourism spending. Similarly, a 1989 survey showed that the opportunity to see elk had a measurable impact on the visitor experience in terms of the value of a current trip to the park (Duffield 1991a). While wildlife viewing is a primary activity in Yellowstone National Park, there have been no studies to date that explicitly focus on the impact of changes in bison populations on visitation levels or the visitor experience.

TABLE 14: ORDER OF PREFERENCE TO SEE ANIMALS IN YELLOWSTONE NATIONAL PARK

Rank	Species	Percent	Rank	Species	Percent
1	Grizzly	55	12	Otter	3
2	Black bear	33.2	13	Whooping crane	2.3
3	Moose	33.2	14	Peregrine falcon	2
4	Elk	23.9	15	Coyote	1.9
5	Mountain lion	22.9	16	Pronghorn	1.8
6	Bighorn sheep	21.9	17	Mule deer	1.3
7	Eagle	18.7	18	Chipmunk	.5
8	Bison	16	19	Harlequin duck	.3
9	Wolf	15.4	20	Sandhill crane	.1
10	Wolverine	4.7	21	Marten	0
11	Swan	3.4			

SOURCE: J. Duffield (1992).
NOTE: Based on percent of respondents ranking the top three animals they would like to see (visitors sampled in August-September 1990).

WINTER RECREATION

Winter use has been growing at an accelerating rate, nearly doubling in the decade between 1984 and 1994, to 140,000 in the 1994–95 winter season. Little overnight backcountry use occurs in the winter. During the winter, 25% of the visitors stopped at Mammoth, while 10% visited Tower Junction. Old Faithful is the single-most common destination, with 60% of winter visitors stopping at that location. Forty-six percent of winter visitors liked viewing the scenery most, and 17% specifically identified

wildlife viewing as what they liked most about the park in the winter (NPS 1990).

In areas surrounding the park winter recreation is also growing. The town of West Yellowstone, Montana, is located at the west entrance to the park and has been touted as "the snowmobile capital of the world." Total entrances to the park through the west entrance for the months of December through March rose 31% from the 1989–90 winter season to the 1994–95 winter season. A 1994 report from the Bureau of Business and Economic Research at the University of Montana suggests that three-quarters of all nonresidents snowmobiling in Montana spent time in or near West Yellowstone (Sylvester and Nesary 1994).

During the 1994–95 winter season, 47% of park visitation entered through the west entrance, 32% through the north, 18% through the south, and 3% through the east.

Paralleling the increase in winter visitation to the park has been winter recreational use of USFS lands adjacent to the park. Table 15 shows historical winter use levels for Yellowstone National Park and adjacent Gallatin National Forest. It shows that both aggregate recreational use in the park, and all listed types of use in the national forest have been trending upward over the decade 1984–94.

During the winter season, the major recreational activity in the Horse Butte area is snowmobiling, which begins around December 1 each year and lasts until March 30. Records are not kept of dispersed recreational use in the area. Snowmobile use occurs throughout the groomed trail system and play areas, and the majority of the play areas are located on Horse Butte Peninsula. Snowmobiles are also used to reach ice-fishing areas, most notably on the Madison Arm of Hebgen Reservoir.

Minor amounts of cross-country skiing occur in the area, primarily on Horse Butte itself. Snowmobiling and cross-country skiing are also important winter recreational activities that take place mostly at the upper elevations above Jardine. Records are not kept for dispersed recreation use in the Horse Butte area.

TABLE 15: WINTER USE LEVELS BY YEARS FOR YELLOWSTONE NATIONAL PARK AND GALLATIN NATIONAL FOREST

Year	Yellowstone National Park Winter Recreational Use Level	Gallatin National Forest		
		Hebgen Lake District Wide	Cooke City	Hebgen Lake Rendezvous Trail
		Snowmobiles	Snowmobiles	Skiers
1984–85	77,679	47,552		4,125
1985–86	93,971	46,100		4,325
1986–87	89,615	50,333		6,866
1987–88	100,105	64,300		7,874
1988–89	96,304	62,200		
1989–90	118,017	84,800	10,000	15,138
1990–91	103,539	69,800		11,800
1991–92	117,410	74,900		13,052
1992–93	141,510	81,500		13,308
1993–94	143,523	75,054	38,000	14,497
1994–95	139,810	87,245		21,617
1995–96	119,539	106,713	37,050	22,055

SOURCE: Winter Visitor Use Management: a Multi-Agency Assessment, Greater Yellowstone Winter Visitor Use Management Working Group, April 1997.

HUNTING

Big-Game Hunting

The focus of this discussion will be on elk, the type of hunt most likely to be affected by bison management. Hunting seasons occur during the fall and early winter in Montana. The elk general rifle season occurs from the fourth week of October to the fourth week of November for a five-week season. An archery season occurs from the first week of September to mid-October, allowing one-either-sex elk per hunter. Special permits are issued for harvest of antlerless elk during the general hunting season and late hunts for elk. Mean harvest of elk in and near the analysis area is 3,044. By comparison, deer harvest is 2,564, moose is 93, bighorn sheep is 22, mountain goats is 10, and pronghorn is 23.

In Montana, elk are managed in elk management units. These units are divided into one or more hunting districts (delineated in Montana's big-game hunting regulations) that share similar ecological characteristics and, in most cases, encompass the year-long range of major elk populations inhabiting the management unit (Youmans 1992). The analysis area outside the park includes three elk management units and their respective hunting districts: the Gallatin (hunting districts 301, 310, 314), the Madison (hunting districts 310, 360, 361, 362), and the Emigrant (hunting districts 313, 314, 316). The northern Yellowstone elk herd (approximately 18,000 animals) occupies winter and summer range in Yellowstone National Park, and is associated with hunting districts 313 and 316. These elk winter in what is described as the northern Yellowstone elk winter range, which includes about 400 square miles from the Lamar Valley in the park west and north to the Dome Mountain Wildlife Management Area outside Yellowstone National Park in hunting district 313. Hunting district 316 is primarily high elevation summer and fall range, with most elk typically migrating to the northern winter range in the park. Elk wintering and summering near the northwestern corner of the park are associated with hunting districts 360, 361, 362, and 310. The elk hunt is perhaps most similar to the proposed bison hunts for alternatives 3 and 4 and the special permit Gallatin and Gardiner Late elk hunts. These hunts are primarily for elk that have migrated out of Yellowstone National Park during the winter months.

Bison Hunting in North America

The American bison is a trophy animal for big-game hunters. Bison hunting takes place on both public lands and private game ranches in North America. Private ranches charge relatively high prices (ranging from $2,250 to $4,000 in the Northern Rocky region) for hunting a trophy-sized bull (see table 16). Just north of Yellowstone National Park, the Flying D Ranch charges $3,500 per bison and receives about 10 customers per year (Numerous personal communications and WEB advertisements).

Bison are hunted on public lands in Wyoming, Utah, South Dakota, and Alaska. Lotteries are held for the Wyoming, Utah, and Alaska hunts. A percentage of the limited permits is reserved for resident applicants. A nonrefundable application fee of $5 to $10 is required. The permits for nonresidents range from $1,008 to $2,605. The tag cost for residents ranges from $0 (Alaska) to $1,105 (Utah). All hunters must have state big-game hunting licenses.

Three public bison hunts have taken place in the Greater Yellowstone Area in the 1990s: a discontinued hunt in Montana, a discontinued hunt on the Jackson herd south of Yellowstone National Park, and an ongoing Wyoming hunt, officially called the "Wild Bison Reduction Season" held on the Absaroka herd. The Absaroka herd unit is located on the north fork of the Shoshone River near Cody on the east side of Yellowstone National Park, and is part of the larger Yellowstone population. The Montana hunt held in the mid 1980s and early 1990s was discontinued after it received bad publicity because the bison were shot in a firing line situation as they crossed the border of Yellowstone National Park into Montana. In addition, the hunters were accompanied by

Montana Fish, Wildlife and Parks personnel, and many bison were shot within a short time period. The hunt on the Jackson herd in Wyoming was discontinued during the development of a bison management plan by the National Park Service, U.S. Fish and Wildlife Service, state of Wyoming, and U.S. Forest Service.

The wild bison reduction season on the Absaroka herd is held in the following manner. Applications are accepted during a specified time period in late summer and are randomly assigned a draw number. When the Wyoming Game and Fish Commission determines that the bison population needs to be reduced, they notify the applicants in order of their draw number. The applicant is then interviewed, asked to demonstrate his/her capacity to use a firearm, and is instructed on the issues involved in hunting a bison. If the applicant "passes" the interview, they are allowed to hunt (on their own) for their animal. The population objective for the Absaroka herd is 15 bull bison. Public hunting is employed to remove all female bison and all male bison in excess of that objective. In 1996, 17 bison were taken at a 100% success rate. Despite its close proximity to Yellowstone National Park, this hunt was not protested, in part because of its low profile, the small number of bison killed, the lack of a specific time or opening date, and lack of hunter accompaniment by agency officials.

TABLE 16: A SAMPLE OF BISON HUNTING IN THE UNITED STATES

Location/Ownership of Herd	Cost per Bison	Bison per Year	Number of Applicants
Private herds			
Flying D (Gallatin County, MT)	$3,500	No set limit	About 10
Windels Wildlife Preserve (Hogeland, MT)	$4,000	4	First-come, first-served
Terrills (Cheyenne, WY)	$2,250	--	--
Fort Belknap Reservation (MT)	$2,500 for 4-6 year old $4,000 for trophy-size	4	First-come, first- served
Public Herds			
Henry Mountains, UT	$1,008 nonresident $408 resident	44	Data not available
Antelope Island, UT	$2,605 nonresident $1,105 resident	6	1,000s
Delta Bison Range, AK	$450 nonresident $650 nonresident/alien $0 resident	40	6,000–11,000
Custer State Park, SD	$3,000 for 3-day hunt	10	About 20
Absaroka Herd, WY	$1,688 nonresident $275 resident	17	2,316
Discontinued Hunts			
Yellowstone Herd, MT (1990)	$1,005 nonresident $205 resident	Data not available	Data not available
Jackson Herd, WY (1990)	$1,000 nonresident $200 resident	16	3,000+

The purpose of taking action is to prevent the transmission of brucellosis from Yellowstone bison to cattle. Since some alternatives would have specific impacts on livestock operations in the region, cattle operations in the Greater Yellowstone Area are analyzed in greater detail in this environmental impact statement than are other land use practices (such as residential and commercial). The monetary aspects of ranching, e.g., the contribution to the regional economy, are included in the "Socioeconomics" chapter of the document.

CATTLE MANAGEMENT PRACTICES

In the Yellowstone area, the livestock industry is composed mainly of cow-calf operations with the exception of a few sheep producers. Privately owned land and leased public land grazing allotments provide summer pastures. After the first snowfall, or at the end of the allotment period in the fall, most cattle are returned to their home base, usually elsewhere in Montana or Idaho where snow depths are more shallow and hay sources are more accessible. Near Yellowstone National Park in the winter, the snow is too deep and the winters are too cold for cattle to graze, and extra feed is required to maintain their body heat. Cattle under lease are fed hay and retained at Royal Teton Ranch (adjacent to the park's northwestern boundary) year-round.

The mother cows of a cow-calf operation are usually bred in the spring or summer for calving in late winter or spring. Calves are with their mothers until fall, at which time they are weaned. Intensive management activities, including calving, neonatal care, branding, castration, dehorning, semen testing, and breeding usually take place at a producer's home operation.

Yearly phases of production include weaning of calves, feeding or selling steers and surplus heifer calves, and culling of old or unbred cows. Owners of cow-calf operations usually do not purchase cattle, with the exception of breeding bulls, but rather rely on replacement heifers from the same herd. Their incomes generally reflect the 10- to 12-year price cycle for beef. Income in some years may not cover expenses, but usually a positive cash flow is realized by the completion of the cycle.

At the producers' discretion, female cattle in the park vicinity are vaccinated against brucellosis one time, between 4 and 12 months of age. Yearly testing for brucellosis is performed on an estimated 80%–90% of the cattle grazed in the West Yellowstone area. These are herds brought from Idaho for summer grazing, since by agreement with Montana, Idaho requires that cattle 18 months or older pasturing in the West Yellowstone area be tested when entering Montana, and again before returning to Idaho, regardless of any known exposure. If Montana's Department of Livestock suspects that cattle may have been exposed to brucellosis, then area (whole herd) testing can be required, including calves as young as six months. Area testing last occurred in the Reese Creek area in 1989.

Cattle drive.

LAND USE

Land to the north and west of Yellowstone National Park is primarily part of the Gallatin National Forest, with some areas of privately owned property. The two existing management

areas designated in the *Interim Bison Management Plan* are located on national forest land adjacent to the park. The Eagle Creek/Bear Creek area, located northeast of Gardiner, has about 23,000 acres. The Horse Butte area, located northwest of West Yellowstone, is about 24,000 acres in size. The interim plan allows for the winter migration of bison into these two management areas (only ones tested seronegative in West Yellowstone).

Active cattle allotments identified as lying within potential bison habitat are shown in table 17. Cow-calf pairs grazed on these public allotments on the Gallatin National Forest and on nearby private land managed by the U.S. Forest Service number about 625 to the north of the park and about 494 in the West Yellowstone area.

TABLE 17: ACTIVE CATTLE GRAZING ALLOTMENTS TO THE NORTH AND WEST OF YELLOWSTONE NATIONAL PARK, LOCATED WITHIN THE MOST EXTENSIVE OF PROPOSED SPECIAL MANAGEMENT AREAS

	Number of Cow-Calf Pairs		
Allotment Name	**On National Forest Land**	**On Private Land Included as Part of the Allotment[1]**	**Total**
Gardiner Area			
Green Lake	59	0	59
Lion Creek	53	47	100
Park	20	130	150
Section 22/Mill Creek	35	14	49
Sentinel Butte	7	0	7
Slip-and-Slide	260	0	260
Subtotal	**434**	**191**	**625**
West Yellowstone Area			
Basin	16	0	16
Horse Butte	142[2]	0	142
South Fork	19	0	19
Sulphur Springs	37	2	39
Wapiti	222	0	222
Watkins Creek	56	0	56
Subtotal	492	2	494
TOTAL	**926**	**193**	**1,119**

SOURCE: U.S. Forest Service, U.S. Department of Agriculture.

1. Private Property adjacent to a grazing allotment on national forest land can be designated as part of the allotment at the discretion of the national forest. The U.S. Forest Service determines the maximum number of cow-calf pairs permitted on both the private and national forest parts of an allotment.
2. This allotment also permits 30 horses.

Privately owned land in the Reese Creek area that could be affected by one or more of the alternatives includes both livestock holdings and nonranch residences, with the latter, in particular, found along the Yellowstone River. The largest of the livestock operations in the Reese Creek area is the Royal Teton Ranch, with about 250 cow-calf pairs grazed on public and private land. It has many buildings and improvements.

Other private properties in the Gardiner Valley, between the Yellowstone National Park boundary and north to Yankee Jim Canyon, occupy a total area of about 2,100 acres. These property owners would only be affected should alternative 2 be implemented. Some of these properties do have cattle, but usually only a few head. As described in the "Environmental Consequences," the number of cattle on grazing allotments and private holdings to the north of the park that may be directly affected varies,

depending on the size and location of the SMAs proposed for each alternative.

In the West Yellowstone area, there are four private holdings (totaling about 1,250 acres) in the Horse Butte region between Duck Creek and the Madison River. Only the largest, with an area of about 650 acres, has cattle, with about 215 pairs on private land (as well as the 142 pairs on the Horse Butte allotments).

Additional private holdings to the west of Hebgen Lake, and south of the Madison Arm of Hebgen Lake (west of the South Fork), would be directly affected only by alternative 2, which has the most extensive SMAs. These areas have an additional 585 cow-calf pairs.

Table 18 shows the estimated number of cow-calf pairs expected to be directly affected by each of the seven alternatives set forth in this environmental impact statement. Impacts vary across alternatives, as described in the "Environmental Consequences."

BISON RANCHING

There are approximately 200,000 bison in North America — about 5% on public lands managed by state and federal governments, about 5% on tribal lands, and about 90% on private lands, primarily commercial herds. There are several private bison herds that are more than 30 miles from any proposed SMA boundary, the largest being on the 107,000-acre Flying D Ranch, which has over 3,000 head. Bison are raised for meat, novelty items, breeding stock, trophy hunting, and wildlife preserves and zoos. Bison ranching is a young and rapidly growing industry. The National Bison Association estimates that 7.5 million pounds of meat from approximately 15,000 bison are sold annually in the United States. However, the industry is extremely small compared to the cattle industry, which slaughters over 124,000 cattle per day.

The auction price of live bison was fairly constant in the United States from 1975 to 1985, averaging about $600 per animal at the National Bison Association Gold Trophy auction in Denver. Since then, however, the average price per animal has steadily increased to an all-time high of about $4,400 per animal in 1997 with a yearling bull selling for as much as $36,000 at the Gold Trophy Show on January 25, 1997. The price of a live bison depends on its age, sex, and the location of the sale. Heifers, mature cows, and mature bulls are generally more valuable as breeding stock than as meat. Table 19 samples the results for recent auctions in Montana and South Dakota, and compares them to the 1997 National Bison Association Gold Trophy auction.

Seven Native American tribes in the Greater Yellowstone Area (Crow, Shoshone-Bannock, Gros Ventre, Assiniboine, Blackfeet, Northern Cheyenne, and Arapaho) have bison herds. At the present time, many tribes want bison to start or increase their herd. Other tribes such as the Crow are in the position of donating or selling bison to other tribes because their herd has reached capacity. The Crow herd increased in size to from 76 bison in 1973 to 1,500 by 1995. (Ravandal, unpub. data 1997).

The alternatives are not expected to have more than a negligible impact on bison ranching; therefore, it is not analyzed as a topic in the "Livestock Operations" section of the "Environmental Consequences." However, it is included here to show auctioning live bison may result in agency income higher than the $337 average from the auction of bison meat, hides, and heads used to calculate revenues for each alternative (also see "Bison as Food" in the "Socioeconomics" section). Only those alternatives with quarantine facilities (currently alternatives 3, 4, and 7) would be able to provide a source of live bison, as any seronegative Yellowstone bison must complete a full quarantine protocol before it could be transported to a reservation or other location.

TABLE 18: ESTIMATED NUMBER OF COW-CALF PAIRS FOUND IN THE PROPOSED SPECIAL MANAGEMENTS AREAS BY ALTERNATIVE

	Gardiner Area				West Yellowstone Area				
Alternative	On National Forest Land	On Private Land Included as Part of the Allotment	On Other Private Land[1]	Total	On National Forest Land	On Private Land Included as Part of the Allotment	On Other Private Land[1]	Total	Grand Total
1	0	0	0	0	364	0	215	579	579
2[2]	434	191	100	725	492	2	800	1,294	2,019
3[2]	86	130	100	316	364	0	215	579	895
4	0	0	0	0	364	0	215	579	579
5	No special management areas would be established.								
6	0	0	0	0	364	0	215	579	579
7[2]	86	130	100	316	364	0	215	579	895

SOURCE: U.S. Forest Service, U.S. Department of Agriculture.

1. The number of cow-calf pairs on private lands not under allotment management may change at any time. On the private lands included in alternative 2, it is possible for cow-calf pairs to number as many as an estimated 400 in the Gardiner area. Although the special management area in the Gardiner area proposed under alternative 2 is much larger than that under alternatives 3 and 7, the number of cow-calf pairs is estimated to be about the same because of where the cattle are grazed.
2. Phase 1 of these alternatives is the same as alternative 1; includes phase 2 cow-calf pairs.

TABLE 19: AVERAGE AUCTION SALES FOR BISON FROM DIFFERENT REGIONS

Age Group	National Bison Range (Moiese, MT) Sept. 7, 1996	Custer State Park (Black Hills, SD) Nov. 16, 1996	Gold Trophy Show (Denver, CO) Jan. 25, 1997
Yearling heifer	$2,156	$3,556	$4,572
2-year-old bull	$1,414	$1,627	$7,781
Mature cow	$2,351	$3,366	$5,914 (bred)
4-year-old bull	$1,988	--	--
Average	$1,834	--	$4,400

SOURCE: National Bison Association 1997a.

PROPERTY DAMAGE BY BISON

In 1991, 90 incidents involving bison (1 to 55 bison per incident, but usually involving small groups of bulls) were recorded by the Montana Department of Fish, Wildlife and Parks, the agency responsible before 1994 for managing and recording bison-related complaints and incidents. Most reported incidents (92%) were complaints originating in the West Yellowstone area along U.S. Highway 191, with the remainder reported in the Gardiner area. The incidents include road nuisances, threats to personal and livestock safety, and property damage, as shown in table 20 for 1991–93. Losses due to road accidents, livestock damage, and fences and landscape destruction were not recorded, with the exception of damage to one vehicle in 1992 valued at $1,000.

In Yellowstone National Park during 1993 and 1994, five motor vehicle accidents were the only visitor reports of private property damage caused by bison. Damages were estimated to total $17,800. Records were not examined before 1993, but personal accounts indicate that this frequency of bison-related accidents is typical. Records of damage to public property by bison are not maintained. During 1996, a total of 15 motor vehicle accidents involving bison inside Yellowstone National Park were recorded. In 1997, 14 accidents inside the park and 2 in the vicinity of neighboring areas of Montana were recorded (NPS, unpub. data).

While anecdotal accounts might suggest that bison damage to public and private property is not a major problem, the individuals directly affected sometimes sustain sizable costs. Recent instances in which horses have been gored by bison demonstrate the serious but infrequent threat bison can pose for livestock producers.

TABLE 20: NUMBER AND TYPE OF BISON NUISANCE INCIDENTS IN THE STATE OF MONTANA – 1991-1993*

Type of Incident	1991	1992	1993
Reported bison incidents	90	47	6
Bison involved in total incidents**	435	124	21
Incidents			
Road nuisance	23	12	2
Road kills	5	2	2
Fence damage	12	6	0
Landscape damage	2	2	1
Property damage	1	1	1
Personal safety	19	5	2
Threat to livestock	24	9	0
Vehicle damage	7	5	2
On property	17	10	0
Injured bison on road	4	5	1

* Most recently recorded data.

** May involve the same bison more than one time.

REGIONAL ECONOMY

The analysis area for the regional economy is a part of the Greater Yellowstone Area. It includes Park and Gallatin Counties, and in some cases (livestock sector analysis) Madison County, as well as portions of Yellowstone National Park (see the Region and Greater Yellowstone Area maps).

Throughout the Greater Yellowstone Area, public lands provide the basis for much of the economic activity (recreation, mining, forestry, and agriculture) that occurs in the region. The area's overall economy has been changing for more than 20 years. The economy has shifted from commodity-extraction dependence to a more diversified economy based on recreation, tourism, and service industries. For example, between 1969 and 1989, more than 96% of all new jobs in the Greater Yellowstone Area came from sectors other than timber, mining, and agriculture (Rasker, Tirrell, and Kloepfer 1992).

Employment

The diversification of the economy in the GYA and the growth in the total number of jobs has helped keep unemployment in Gallatin and Park Counties relatively low, between 2.6% and 4.8% in 1996 (Montana Department of Labor and Industry annual figures). The economy is diversifying to include both extractive industries and service industries and provides a more stable employment for the region.

Employment by economic sector in the two counties is shown in table 21. Approximately 10% of Park County employment and 5% of Gallatin County employment is in the agriculture, forestry, and mining sectors. In addition, some component of employment in manufacturing, wholesale and retail trade, and services is derivative of activity in these resource-based sectors. Most jobs pertaining to the recreation and tourism industry are found in the retail trade and service sectors of a county's economy.

Income

Total employment for the two-county area is shown in table 21, while the percent allocation of income by major industry is shown in table 22; retail trade and services account for approximately 40%–45% of each county's earnings. These sectors, along with the government sector, have a strong tie to the region's resources and are expected to continue to be important and sustaining segments of the economy of the Greater Yellowstone Area.

Recreation Sector

Park Visitors. As noted in the "Recreation" section, recreational use of the affected environment is a key component of the area's economy. Visitors to Yellowstone National Park from outside Montana, Wyoming, and Idaho spent an average of $840.00 during their trips (Duffield 1992).

A 1994 report on snowmobiling in Montana found nonresidents spend approximately $40 million annually in the state, and three-fourths of those nonresidents spent time in or near West Yellowstone (Sylvester and Nesary 1994).
A 1997 study commissioned by the National Park Service estimated the economic effects of the winter 1995–96 government shutdown on local economies surrounding park units (Neher, Robison, and Duffield 1997). Yellowstone National Park and the community of West Yellowstone, Montana, in particular, served as a case study. The NPS report estimated a statistical relationship between Yellowstone National Park west gate entrances and West Yellowstone sales tax collections for the period January 1989 through February 1996. The study found a significant difference between estimated tourist expenditures in West Yellowstone for

Table 21: Industry Breakdown of Employment for Park and Gallatin Counties, 1994 (Number of Individuals Employed)

Industry	Park County	Gallatin County	Total
Total farm	481	1,032	1,513
Total nonfarm	8,144	38,292	46,436
Private:	7,351	30,351	37,702
Misc. agr. and forestry	233	606	839
Mining	122	214	336
Construction	557	2,910	3,467
Manufacturing	624	2,614	3,238
Transport/utilities	400	1,410	1,810
Wholesale	502	1,405	1,907
Retail	1,732	8,622	10,354
Insurance/real estate	399	2,504	2,903
Services	2,782	10,066	12,848
Government	793	7,941	8,734

SOURCE: U.S. Dept. of Commerce, Bureau of Economic Analysis, Regional Economic Information System, 1996.

Table 22: Percent Allocation of Income by Major Industry for Park and Gallatin Counties, 1994

Industry	Park County	Gallatin County
Mining and construction	11.24	10.84
Manufacturing	10.94	7.92
Other*	13.32	11.71
Retail trade	14.72	16.26
Finance, insurance, and real estate	2.80	4.10
Services	31.04	25.11
Government	12.50	21.53
Farm	3.44	2.53

SOURCE: U.S. Dept. of Commerce, Bureau of Economic Analysis Regional Economic Information System, 1996.

* Includes agriculture services, forestry, and fisheries; transportation and public utilities; wholesale trade.

the winter and nonwinter periods. For the winter months of December through March it was estimated that each west entrance visit accounted for $152.67 in expenditures in the West Yellowstone economy. Nonwinter visitor expenditures were estimated to be $25.37 per visit. Impacts of the shutdown are discussed in the "Environmental Consequences" part of this document.

A remaining element of the affected environment with regard to park visitors is the possibility of a tourism boycott. The call for a boycott would likely be associated with the killing of bison, either by agencies or hunters. Boycotts have been attempted in response to the hunting of Yellowstone bison in 1988–89, and in response to high levels of agency shooting and slaughter during the winter of 1996–97 under the provisions of the interim plan.

Hunters. From 1987 to 1990 bison that migrated out of Yellowstone National Park into Montana were hunted by sportsmen in a controlled situation. Expenditures associated with this activity were not measured, but elk hunter expenditures probably provide a good estimate of what bison hunters would spend. Big-game hunting is a major activity in the Greater Yellowstone Area in Montana, and elk and deer are the primary species hunted during the season. Resident elk hunters spent an average of $54.00 per day while resident deer hunters spent $41.00 a day. Average nonresident hunters expenditures associated with elk and deer hunting are $252.00 and $115.00 per day, respectively (Duffield 1988).

Cattle grazing near Mission Mountains, Montana, by G. Wunderwald. (NPS photo)

Livestock Sector

Based on USFS information on cow-calf operations to the north and west of Yellowstone National Park, it is estimated that there are about 725 cow-calf pairs to the north of the park and 1,294 pairs in the West Yellowstone area grazing land that would lie within the boundaries of the most extensive of the SMAs described in this environmental impact statement. Gallatin County has about 62,000 cattle and calves, and Park County has about 58,000 cattle and calves, as shown in table 23.

Table 23 also indicates some differences between the livestock populations in the two counties. Gallatin County has livestock cash receipts 1.6 times those of Park County. Whereas Gallatin County has a smaller number of beef cows, this is balanced by larger milk cow, sheep, and swine populations, and twice the number of total farms and ranches found in Park County. As the last column of the table shows, livestock cash receipts for the two counties together represent about 5% of livestock cash receipts statewide.

Madison County is also included in table 23 (and table 24). Although it does not border Yellowstone National Park, during the winter of 1996–97 there were two instances of bison migrating along roads to within 1 mile of livestock in Madison County. Nine bison made the trek in January, and 13 bison made the trek in late February. As shown in table 23, Madison has a significant livestock industry that could be jeopardized by such incursions. Although Gallatin, Park, and Madison Counties contain a relatively small portion of Montana's total livestock wealth, cattle are at least as important to these counties' economies as they are for the state as a whole, as indicated in table 24. About one-half of agricultural cash receipts for Gallatin County and for Montana are from the sale of livestock and livestock products. In Park and Madison Counties, livestock provide around 80% of agricultural cash receipts.

Approximately 37% of Montana's agricultural cash receipts came from cattle and calf sales.

TABLE 23: LIVESTOCK PRODUCTION IN GALLATIN, PARK, AND MADISON COUNTIES, AND STATE OF MONTANA

	Total Farms/ Ranches 1992[1]	Approximate Acres and Proportion in Farms/Ranches 1992[2]	All Cattle & Calves Jan. 96[3]	Beef Cows Jan. 96[3]	Milk Cows Jan. 96[3]	Sheep Jan. 96[3]	Swine Dec. 95[3]	Livestock Cash Receipts 1994[4]
Gallatin Co.	789	1,604,386 - 43.6%	62,000	27,000	4,900	6,200	2,400	$31,538,000
Park Co.	385	1,699,943 - 45.8%	58,000	35,700	--[5]	2,500	--[5]	$19,685,000
Madison Co.	418	2,295,443 - 55.4%	94,000	56,000	--[5]	9,500	1,200	$27,949,000
State of MT	22,821	92,999,006 - 64.1%	2,750,000	1,570,000	20,000	430,000	180,000	$1,057,318,000

SOURCE: Montana Agricultural Statistics Service and USDA, National Agricultural Statistics Service.

1. Annual sales of agricultural products of $1,000 or more, 1992. 1992 Census of Agriculture, Table 6. No county-level data available since 1992. (Note: Montana's total farms and ranches in 1996 numbered 22,000. 1996 Montana Agricultural Statistics, p. 13.)
2. 1992 Census of Agriculture, Table 6.
3. 1996 Montana Agricultural Statistics, pp. 93, 94, and 95.
4. Bureau of Economic Analysis, U.S. Department of Commerce, 1996 Montana Agricultural Statistics, p. 17. Includes estimates of interfarm and intrastate sales.
5. Less than 500 head or individual operators having 60% or more of the head in county.

TABLE 24: CASH RECEIPTS FROM LIVESTOCK FOR GALLATIN, PARK, AND MADISON COUNTIES, AND MONTANA, 1994

	Livestock and Livestock Products	All Agricultural Cash Receipts	Proportion from Livestock
Gallatin County	$31,538,000	$66,578,000	47%
Park County	$19,685,000	$24,804,000	79%
Madison County	$27,949,000	$33,428,000	84%
State of Montana	$1,057,318,000	$2,296,457,000	46%

Source: Bureau of Economic Analysis, U.S. Department of Commerce.

This demonstrates the importance of cattle, and especially cow-calf production, for the state. Statewide, the number of cow-calf operations in 1996 numbered 13,200, and the inventory of cattle and calves totaled 2.7 million in January 1997. Because Yellowstone National Park bison are exposed to brucellosis, their movement into Montana subjects livestock producers in that state to risks of disease transmission and economic sanctions from state animal health authorities. Therefore, the affected environment potentially includes, indirectly, Montana's entire cattle industry, in addition to livestock producers directly affected in areas adjacent to Yellowstone National Park.

BISON AS FOOD

Bison meat sells for nearly twice the cost of beef because it is considered a health food by some consumers. It is lower in fat than beef and is generally organically grown. The current retail price of bison meat ranges from $3.95/lb (90% lean hamburger) to $17.95/lb (tenderloin) in Colorado. Most of the commercially available meat comes from 24- to 30-month-old bulls that weigh from 900 to 1,100 pounds. This slaughter weight is equivalent to the standard cattle slaughter weight. The dressing percentage of bison (60%) is similar to cattle (Hawley 1989). Finished bulls are sold for 1.30/lb, or $1,450 for a 1,100-pound bison (adjusted to 1996 U.S. dollars) (Baier 1991). The hides, horns, and skulls are also valuable (Hawley 1989).

The meat of older bison is tough and gristly and used mostly for hamburger. The salvage (hamburger) value for a mature cow bison is about $800 and a mature bull is $1,500 (National Bison Association 1997b).

During the 1996–97 winter, the Montana Department of Livestock slaughtered and sold at auction 459 bison for a total of $154,506, averaging $337 per animal. This value per animal was probably much lower than market price for several reasons: (1) the bison were not necessarily of marketable age (either older or younger than the optimal market age), (2) some of the bison were suspected to have brucellosis, which, although not a human health risk in consuming the meat, may have been perceived as such, (3) the perception that the bison left Yellowstone National Park in search of food suggests they had low body weight, (4) there is not an established market in Montana for bison auctioned by the Department of Livestock, and (5) the unexpectedly large number of bison sold in such a short time may have lowered the going price. The most saleable item apparently was trophy-size heads (skulls and horns), which sold for as much as $380 apiece (Wilkinson 1997).

MINORITY AND LOW-INCOME POPULATIONS

Alternative bison management strategies have the potential to affect differing socioeconomic groups in different ways. Table 25 gives an overview of how Park and Gallatin Counties compare to the state of Montana in per capita income and percent of population in poverty and unemployment rate. Also shown in the table are these statistics for the Montana Native American population. As of the 1990 U.S. census, Park County had a per capita income of $11,378, approximately equal to that of the state of Montana. Gallatin County had a substantially higher income level of $17,032 per person. The percent of the population in poverty across the two counties and the state was relatively consistent in 1990 at between 15.2% and 17.1%. Unemployment in the two counties in 1996 was below the state average of 5.3% (Park and Gallatin County unemployment was 4.8% and 2.6%, respectively). Table 25 shows that Montana's Native American population had a much lower per capita income ($5,422) than either the two counties or the state, and a much higher percent of population living in poverty (46.1%) and unemployment rate (26.2%) much higher than the counties or the state.

Management officials and hunters have killed a total of 3,076 bison outside the park in Montana between 1984–85 and 1996–97, including 1,084 killed under the federal- and state-approved interim management plan in 1996–97. The killed bison have been donated to charities and Native Americans who were able to go to the shooting location and gut and haul away the carcasses. Native American tribes, tribal members, and affiliated organizations received about 60% of the bison killed in 1991–92, 90% of those killed in 1994–95, and 47% of those killed under the interim management plan in 1996–97. Native Americans have received over 1,000 bison carcasses since the 1991–92 winter. Charities received about 7% of those killed in 1996–97 (State of Montana, Clarence Siroky, pers. comm. 1997), and have also received bison carcasses in previous years.

Tribes, Indian alliances, and individual tribal members that have received bison include the Blackfeet, Salish and Kootenai, Gros Ventre, Assiniboine, Nez Perce, Shoshone-Bannock, Crow, Cherokee, Chippewa, Little Shell, Yakima-Umatilla, Rosebud Lakota Sioux, Ogalala Sioux, Sisseton Wahpeton, Northern Cheyenne, the Montana State University-Big Sky Indian Alliance, Helena Indian Alliance, and the Butte Indian Alliance.

In addition, charities (not directly affiliated with Native American groups) receiving bison include the Baptist and Community Churches in Gardiner, Gallatin Food Bank, Bozeman Shelter Care, Gold Hill Lutheran Church in Butte, Livingston Food Bank, Powell County Senior Citizen Group, St. Paul's Lutheran Church in Harlowton, St. Mary's Catholic Church in Livingston, West Yellowstone Food Bank, Montana Guides and Outfitters Food For the Hungry, and the Whitefish Food Bank.

Table 25: Comparative Statistics on Economic Status, 1989

Statistic*	Montana Native Americans	Park County	Gallatin County	State of Montana
Per capita income	$5,422	$11,378	$17,032	$11,213
Percent of population in poverty	46.1%	15.2%	17.1%	16.1%
Percent unemployment	26.2%	4.8%	2.6%	5.3%

* Per capita income and poverty status statistics and Native American unemployment rate are from U.S. Bureau of the Census, 1990 U.S. Census Data. Percent unemployment is from Montana Department of Commerce, Office of Research and Analysis, Helena, MT.

SOCIAL VALUES

This section describes general attitudes toward wildlife and the livestock industry. None of these attitudes is superior or inferior to another.

The general public has strongly held divergent values and opinions on public policy issues concerning wildlife management. As an example, the draft environmental impact statement concerning wolf recovery in Yellowstone National Park received over 160,000 comments, more than any other federal action ever proposed in the U.S. (E. Bangs, pers. comm. 1997). Similarly, proposals concerning the use of leg-hold traps, bear-baiting, and aerial gunning of wolves have been decided through public referenda in states including Colorado, Idaho, and Alaska.

The general public also has strongly held divergent values and opinions on public policy concerning ranching. Since the mid-1890s, livestock ranching has been an integral part of Montana's social character. Ranching and other agricultural activities continue to provide open range for wildlife. All 56 of Montana's counties have livestock operations.

The social values at issue in the bison-brucellosis conflict in the greater Yellowstone ecosystem are as disparate as the participants. As Thorne, Meagher, and Hillman (1991) comment: "Whereas most people regard the GYE [Greater Yellowstone Ecosystem] and its wildlife as a world treasure, because of its reservoir of brucellosis, others regard the GYE as a threat to an important international industry and economy and a black eye to their efforts."

Management of bison in the Yellowstone area has become a matter of national attention and interest. In recent years individuals and groups representing many viewpoints have challenged management practices, both in court and in a variety of public forums.

Some residents across the country may not understand the science behind the management actions of alternatives in this environmental impact statement because many perceive the bison as an endangered species, which it is not.

Rural Way of Life

Montana has remained a very rural state deep in traditions founded in this rural way of life. Most Montanans believe agriculture and the businesses and communities it supports are paramount in maintaining this way of life.

While Montana's population and distribution of population has fluctuated and changed over its history, it remains rural. In 1989 about 53% of Montanans lived in urban areas compared to 74% nationally. Montana's first census conducted in 1870 found that the territory had fewer than 21,000 people. Today Montana is the fourth largest state geographically (145,388 square miles), and the 1990 census concluded that Montana had about 800,000 residents. There are 5.5 people per square mile in Montana, and no city has a population of 100,000 (Montana Agriculture Statistic 1996).

Native Americans

Bison embody the culture of many native Plains peoples. Bison are a link to the spiritual world; many tribes connect their cultural and spiritual identity to them. Bison were perceived as the "great provider" for nonagrarian tribes as they were essential to the spiritual, cultural, and physical well-being of the tribe. These relationships and beliefs have spanned the centuries of bison and tribal interaction. Today bison are directly tied to ceremonies such as traditional pow-wows. Bison skulls are used as altars, bone is used on traditional costumes, and they are the subject of many dances. Many tribes believe that all animals, including bison, have "intrinsic value that supersedes any value people might place on them." Certain tribes require that the bison must be killed in a respectful manner before it can be used for traditional spiritual practices (Ravandal, unpub. data 1997).

The InterTribal Bison Cooperative is dedicated to the restoration of bison to the daily lives of Indian people for economic development, cultural enrichment, and environmental restoration. They have proposed transporting surplus bison from Yellowstone to tribal reservations where they would join bison already on ranches. Some tribes are not members of the cooperative because they do not agree with the economic emphasis placed on the return of bison.

Hunters

Bison represent a prize game animal "due to its symbolism as part of the West, part is due to its value as meat and as a trophy." Hunting in general is viewed as essential and a natural part of ecosystems, as it is a natural human activity and may be "an instinct after millions of years." Some hunters in the Yellowstone area feel that the population of bison needs to be lowered. Most believe that an environment containing healthy populations of a variety of species can support human use of the area. (Ravandal, unpub. data).

Cattle Ranching

Cattle ranches and the cowboys who ran them represent a different type of "popular cultural icon" as "people around the world recognize the American cowboy as a national symbol" (Slatta 1991, 243). Cattle frontiers "separated indigenous and European cultures" from the onset. "White, European values met and mixed with indigenous cultures on the Plains" resulting in competition for resources. (Slatta 1991, 223).

Organization advocates include the Montana Stockgrowers Association, which is dedicated to promoting the economic, political, environmental, and cultural interests of the livestock industry in Montana. The association works to improve economic opportunities for ranchers, improve access to political avenues in areas of concern, and ensure that the traditional farming and ranching livelihoods are not adversely affected by the continuing evolution of the human or natural environments.

Bison Ranching

Bison were hunted in the past for meat, hide, and bones by North America's first people. Some tribes today wish to begin or expand bison ranching on reservation lands while private ranchers also are involved with managing bison for meat production. The relatively low-maintenance bison have become lucrative market animals.

There are also those who oppose bison ranching (e.g., Farm Animal Reform Movement, Humane Farming Association). They note the environment is damaged enough without bison ranching. They feel that "if left alone by humans, bison do a good job of protecting themselves, and don't need to be exploited in order for the species to survive."

Other groups, such as the Humane Society of the United States, note both positive and negative aspects of bison ranching. As an industry, bison ranching is "ecologically a step forward as an alternative to continuing to graze the wrong

species, namely, cattle, on the high plains and prairies." The negative aspects revolve around questionable husbandry practices, primarily transportation and slaughter. Currently, bison ranchers get more income from skins and skulls than from the carcasses (Dillingham 1997).

Conservation Associations

It is impossible to define a single "conservation ethic," as conservation associations differ in their views depending on the resource they are attempting to conserve. The following views represent only two of many different and divergent conservation groups.

The Greater Yellowstone Coalition's mission is to preserve and protect the Yellowstone area and its unique quality of life including its biodiversity, geothermal activity, rural lifestyle, ranches, and small towns. According to the coalition there is a "fundamental question" for the park's bison management policy: "Is Yellowstone a sanctuary for wildlife or are we going to allow the livestock industry to turn it into a livestock yard and zoo?"

The National Parks and Conservation Association believes "bison should be allowed to roam freely in Montana," and has asked supporters to inform government agencies to that effect. It also holds that "there is an insignificant risk, if any, of the transmission of the bacteria causing brucellosis from bison to cattle," and that "Yellowstone bison are scientifically, historically, and aesthetically important and should be protected." If the state of Montana implements and defends the "anti-bison" policy the association has encouraged that "vacation dollars be spent elsewhere."

Animal Rights Concerns

Animal rights groups believe bison should not be shot regardless of jurisdictional boundaries. Also, they voice concerns over animal rights violations within the overall ranching industry, which they perceive as dominating bison management decisions.

Animal protectionists and open-range cattle ranchers agree on some issues. The most humane domestic ranching operations, according to both, sends fewer animals to market; raises them in the way most natural to the species; treats them with the least cruelty possible; and uses husbandry practices that avoids cruelty to other species. Western cattle ranchers, for the most part, do not confine animals nor are calves separated from their mothers. The animals live in "semi-natural herds under semi-natural conditions." Open-range ranchers are the smallest part of the beef industry but provide a more humane form of meat production for the future (Rollin 1989).

Attitudes Toward Wildlife

There is extensive literature concerning general social attitudes and values towards wildlife, although no systematic surveys of information specific to bison and brucellosis in the Greater Yellowstone Area exist. For example, Kellert (1976) identified a number of distinct attitudes toward wildlife including naturalistic, ecologistic, humanistic, moralistic, scientistic, aesthetic, utilitarian, dominionistic, and negativistic (see table 26 for definitions).

Most people typically possess more than one attitude toward animals and react differently in different situations. Nonetheless, it is possible to identify in most people predominant characteristics of a primary attitude toward animals. For example, animal rights groups tend to have a moralistic attitude towards animals, while scientists tend to take a scientific view (Kellert 1976).

A number of empirical studies reflect attitudes toward wildlife, particularly large carnivores (e.g., McNaught 1987; Llewellyn 1978; Bath 1991; Kellert et al. 1996). Llewellyn classified comments received concerning a proposed change in wolf status in Minnesota from endangered to threatened. Those commenters

who favored maintaining the endangered species classification most frequently expressed ecologistic, moralistic, and naturalistic attitudes (as defined in table 26). By contrast those favoring declassifying wolves had predominantly utilitarian and negativistic attitudes.

Table 26: Perceptions of Animals in American Society

Attitude	Key Identifying Terms	Highly Correlated With	Most Antagonistic Toward
Naturalistic	Wildlife exposure, contact with nature	Ecologistic, humanistic	Negativistic
Ecologistic	Ecosystem, species interdependence	Naturalistic, scientistic	Negativistic
Humanistic	Pets, love for animals	Moralistic	Negativistic
Moralistic	Ethical concern for animal welfare	Humanistic	Utilitarian, dominionistic, scientistic, aesthetic, negativistic
Scientistic	Curiosity, study, knowledge	Ecologistic	None
Aesthetic	Artistic character and display	Naturalistic	Negativistic
Utilitarian	Practicality, usefulness	Dominionistic	Moralistic
Dominionistic	Mastery, superiority	Utilitarian, negativistic	Moralistic
Negativistic	Avoidance, dislike, indifference, fear	Dominionistic, utilitarian	Moralistic, humanistic, naturalistic

Source: S. Kellert (1976).

Approximately 260 comment letters were received concerning the *Interim Bison Management Plan/Draft Environmental Assessment* (NPS and State of Montana 1995). The assessment was issued in December 1995 and most comments were received in January 1996. Based on a review of the written comments, the feature of the proposed plan about which commenters felt most strongly was the killing of bison. This suggests, not surprisingly, that social values related to moralistic and humanistic beliefs and attitudes are definitely at issue in the bison-brucellosis conflict. Also, just as in Llewellyn's (1978) analysis of the wolf declassification issue in Minnesota, another opinion apparent in these letters often strongly expressed practical or utilitarian views concerning the impact of brucellosis on livestock.

The bison-brucellosis controversy concerning the Yellowstone area is not the only such conflict in North America. There is a parallel in Wood Buffalo National Park in the Northwest Territories of Canada. Research into social and economic values is apparently underway in this case (J. Chisholm, pers. comm. 1997). While no formal analysis of social values is yet complete, general public opinions toward several possible management options in Canada have been revealed through public debate. In 1990 the Canadian Environmental Assessment Panel on this issue recommended that "all free-ranging bison now living in Wood Buffalo National Park and surrounding areas be removed and replaced by disease-free bison" (Wood Buffalo National Park 1997). According to Wood Buffalo National Park: "The recommendation of the panel received mixed response. While agricultural interests and some environmental groups supported it, other environmental groups and aboriginal communities protested. There was a national outcry against the recommendation. More than 11,000 written protests were sent to the Minister responsible for Parks Canada; the largest response to any wildlife-related issue in Canada to date." In response to the outcry over the Canadian Environmental Assessment Panel recommendation, the proposal was abandoned and another panel formed. In 1992 the latter panel recommended that because of significant knowledge gaps concerning the

epidemiology and ecological role of the disease and effects of possible management actions that a bison research program be initiated before developing a final action plan. A five-year research program was announced in 1995 and is underway. (Depopulation to the degree proposed in the Wood Buffalo herd is not part of any alternative analyzed in this environmental impact statement. It is cited here simply to show public reaction to bison slaughter.)

NONMARKET VALUES

The wildlife and natural environments of the Yellowstone area bison are of substantial value to winter and summer park visitors, hunters, and other individuals who value the idea that these resources are maintained in a viable state. Part of this value is reflected in the expenditures that visitors make for lodging, food, and other travel services (e.g., see "Recreation Sector" section). However, the main reason that visitors make the often long and expensive trip to see Yellowstone National Park is not primarily to eat in West Yellowstone or spend a night in a motel in Gardiner. Visitors make these trips because the benefits of the trip exceed the dollar costs.

Benefit studies are concerned with the demand side of the tourism industry. Because visitors are charged only nominal or no fees for park visits or use of surrounding public lands for hunting or snowmobiling, trip values do not have market prices.

The nonmarket value (values for items not exchanged in established markets) of trips for both park visitors and hunters is measured by how much they would be willing to pay over and above the costs of the trip before they would choose to forego the trip (Ward and Duffield 1992).

Previous studies have estimated the median nonmarket value of a trip to Yellowstone National Park at $166 for regional (Idaho, Montana, Wyoming) residents and $700 for out-of-state visitors (Duffield 1992). These median estimates indicate that visits to Yellowstone National Park are, as one would expect, highly valued experiences. However, it may be noted that this range of values is not without precedent for recreational trips. For example, Loomis, Cooper, and Allen (1988) estimated the value of elk hunting trips in some Montana districts at around $400/trip. These values would likely be considerably higher at present. Montana Department of Fish, Wildlife and Parks is currently using variable market prices to sell outfitter-sponsored nonresident combination licenses (which are mainly purchased for elk hunting). The market-clearing price in the last two years has been $835. Duffield (1988) estimated the value per day of elk hunting in districts around Gardiner, Montana, at $92.08 (1991 dollars). No estimates of the nonmarket value of snowmobiling in the Yellowstone area are available in the literature. These trips may have a value similar to general park visits.

Wildlife viewing is an important aspect of the Yellowstone National Park visitor experience, and it is likely that the abundance and variety of wildlife a given visitor actually sees affects the satisfaction and value placed on the trip. Duffield (1991) examined how the value of trips to Yellowstone National Park that were taken in October 1989 and August-September 1990 varied by whether the survey respondent had or had not seen elk. The median trip value for regional residents (Idaho, Montana, Wyoming) was $22 higher and $145 higher for nonresidents if elk were seen by the respondent. This study also estimated the impact of a 20% decline in elk populations on trip value. It was estimated that this would lead to only a small (3%) change in the probability that any given visitor would see an elk. The corresponding change in trip values was also small: $0.63 for residents and $4.61 for nonresidents. The annual value park visitors place on having wolves present in Yellowstone National Park for purposes of seeing or hearing them has been estimated at $7.34 for regional residents and $5.48 for out-of-region visitors (Duffield 1992). There have been no estimates reported in the economic literature of the affect of the presence or abundance of bison on the value park visitors derive from Yellowstone National Park.

The economic value of Yellowstone National Park resources is only partly measured by the demand for onsite use by park visitors, hunters, and other users. As the world's first national park, Yellowstone is clearly a resource of national and even international significance (Keiter and Boyce 1991). Many individuals value the idea that this resource and its wildlife are being maintained in a viable state independent of whether they will actually themselves be able to visit the park (USFWS 1994). This type of nonmarket value is sometimes termed "intrinsic," or "existence," or "bequest" value (Krutilla 1967). The existence of the resource itself (separate from direct use) or the motivation to provide the resource for future generations are the sources of this economic value.

There have been several studies of the economic existence or intrinsic value of specific wildlife populations, as summarized in table 27. Generally, these values have been measured in terms of stated willingness of survey respondents to donate to achieve the restoration or augmentation of a given population. Studies listed in table 27 include grizzly bear recovery in the Selway Bitterroot Wilderness (USFWS forthcoming), elk winter range purchases near Gardiner, Montana, to benefit the Northern Yellowstone herd (Duffield 1991b), recovery of wolves in Yellowstone National Park (Duffield 1989, 1991a, 1992; Duffield, Neher, and Patterson 1993; USFWS 1994), protection of bald eagles in Wisconsin (Boyle and Bishop 1987), protection of a population of desert bighorn sheep near Tucson, Arizona (King, Flynn, and Shaw 1988), and preservation of whooping cranes at Aransas National Wildlife Refuge in Texas (Bowker and Stoll 1988). The species for which values are reported are listed in the same order as in table 14, which set forth Yellowstone National Park visitor preference for seeing that animal on a visit to the park. Generally, the animals that people are most anxious to see are those that they are willing to pay the most to protect. However, values held by site visitors do not show a systematic trend, but depend as much on the site and the type of visitors the site attracts. For example, whooping cranes are relatively highly valued by visitors to Aransas National Wildlife Refuge and by the U.S. population, but are not a primary species for viewing in Yellowstone National Park. Also generally speaking, values are highest for area visitors and generally decline for resident populations centered at increasing distances from the site in question. The values in table 27 have been standardized to 1997 dollars (corrected for inflation by the Consumer Price Index), are per person for the relevant human population (corrected, for example, for original study values that are just for respondents in favor of a given action), and are adjusted based on the conservative assumption that nonrespondents to a given survey place a zero value on the species at issue. Nonetheless, there are undoubtedly remaining differences in the values that are in part due to methodology (Loomis and White 1996), the extent to which nonresponse was minimized, and the actual change in wildlife population (restoration vs. increased abundance, for example) and the choice of economic welfare measure (median vs. mean, for example).

No estimates specific to bison are available in the literature. However, as shown in table 27, an approximate bound to a range of possible values for bison may be given by entries lower (wolves) and higher (elk and eagles) in the visitor viewing-preference ranking.

Table 27: Nonmarket Values for Wildlife Preservation (1997 Dollars)[1]

		1997 Human Population Sampled			
Species	**Preference to View[2] (%)**	**Area Visitor ($)**	**Resident Local Counties ($)**	**Resident Local States ($)**	**Resident U.S. ($)**
Grizzly bear[3]	55		14.86	16.65[4]	15.22
Elk[5]	24	32.61			
Bighorn sheep[6]	22		14.74		
Bald eagle	19	28.62[7] to 157.60[8]		13.05[7] 9.32[9] to 13.23[9]	
Bison	16				
Wolf	15	39.46[10]	8.35[11]	8.28[12,13]	3.04[12] to 3.70[11]
Whooping crane[14]	2.3	34.86			12.29

1. All values adjusted to 1997 dollars using the Consumer Price Index. Values are per person for relevant populations (adjusted to account for share in population a given action). Nonrespondents assumed to place zero value on the given wildlife resource.
2. Percent of Yellowstone National Park visitors ranking species in top three they would prefer to see on a trip to the park (Duffield 1992)
3. U.S. Fish and Wildlife Service 1997 (based on 1995 survey). One time contribution. Overall survey response rate used for all human populations.
4. Sample of residents of ID, MT, WY, OR, WA, and UT.
5. Duffield 1989, 1991b (1989 data). Lump sum.
6. King, Flynn, and Shaw 1988. Local area population is Tucson, AZ, desert bighorn sheep. Annual Payment.
7. Boyle and Bishop 1987 (1984 data). Annual membership.
8. Swanson (1993), Visitors to Skagit River Natural Area. Lump sum value.
9. Stevens et al. 1991. Sample of New England households. Annual payment.
10. Duffield 1992 (1991 survey data). Lump sum.
11. Duffield, Neher, and Patterson 1993 (1991 and 1992 survey data). Lump sum.
12. U.S. Fish and Wildlife Service, 1994. (1993 survey data). One time contribution.
13. Sample of residents of ID, MT, and WY.
14. Bowker and Stoll 1988. U.S. sample based on Texas plus four SMSAs (Atlanta, Chicago, Los Angeles, and New York). Visitor area is Aransas National Wildlife Refuge in Texas.

This section describes the threatened, endangered, and sensitive species (collectively referred to as species of special concern) that may be affected by the alternatives (also see appendix H). Other species of special concern inhabit the project area, but are not expected to be affected in any way by the actions described in any of the alternatives.

Bison management has the potential to affect species of special concern in three ways: (1) directly through management actions, such as shooting and hazing, (2) by removing or polluting habitat that would otherwise be available for threatened or endangered plants or wildlife, and (3) indirectly by affecting the numbers and distribution of bison, which serve as live prey or carrion for threatened or endangered animals in some cases. The habitat and other relevant information for species that might be affected by such actions is described below.

ENDANGERED SPECIES

Peregrine Falcon

The peregrine falcon is the only endangered species inhabiting the project area. Peregrine populations have been increasing in the Greater Yellowstone Area. The peregrine is found in open country near riparian areas and typically nests on rocky cliffs or in gorges. Birds are the primary component of the peregrine diet (Langelier 1989).

THREATENED SPECIES

Bald Eagle

The bald eagle, a threatened species, nests and winters within the northern part of the Greater Yellowstone Area. In the analysis area, bald eagles are concentrated around Hebgen and Quake Lakes near the Horse Butte allotment. Bald eagles also winter and nest in the Seven-Mile Bridge area where they feed primarily on waterfowl (McEneany, pers. comm.). Bald eagles will eat bison carrion but also use various fish species and any other carrion available (Harmata 1989). Particularly in the west, bald eagles will scavenge on carcasses of large mammals succumbing to winter kill (Stalmaster 1987). In Wood Buffalo National Park in Canada, bald eagles feed on bison carrion (Young 1983). Scavenging is most common in winter and early spring (Stalmaster 1981). Two studies on food habits in the Yellowstone area showed that mammals comprised 18% (Swenson 1975) and 11% of the bald eagle diet (Alt 1980).

Grizzly Bear

The grizzly bear is classified as a threatened species. The project area is entirely within the Greater Yellowstone Grizzly Bear Recovery Zone and is almost exclusively management situation 1 (MS1) grizzly bear habitat. MS1 contains grizzly population centers (areas key to the survival of grizzlies where seasonal or year-long grizzly activity, under natural, free-ranging conditions is common) and habitat components needed for the survival and recovery of the species or a segment of its population. A portion of the project area falls within MS2 grizzly bear habitat. MS2 areas are those lacking distinct grizzly bear population centers or highly suitable habitat, although some habitat exists and grizzlies may be present occasionally. The entire area inside the park is considered MS1. The majority of the area proposed to be within SMAs under the alternatives outside the park lies within MS1 except for the area west of the park in the Horse Butte area (which is stippled on the alternative maps) and the lower elevation area along the Yellowstone River north of the park which are MS2. The percentage of the SMAs that is comprised of MS2 varies from 0% to approximately 10% depending on the

alternative. In addition, MS3 has not been mapped on the national forest, but consists of developed areas like campgrounds and summer home sites where grizzly bear presence is untenable for humans and/or grizzly bears. Some of these MS3 areas lie within the areas considered as SMAs in the alternatives (i.e., Baker's Hole campground).

The grizzly bear population has increased in recent years (Knight and Blanchard 1995).

General Grizzly Bear Food Habits. Food habits of grizzly bears in the Yellowstone area vary greatly from year to year depending on availability of preferred foods. Although some bears depended heavily on garbage in the interior of the park prior to 1969–70, they shifted their diets to other foods when the dumps were closed in 1969–70 (Craighead, Sumner, and Mitchell 1995). Craighead, Sumner, and Mitchell (1995) suggest that bears may have increased their annual range sizes to compensate for loss of garbage food sources. They also suggest that the bear population decreased and bears redistributed themselves away from the Central Plateau and moved toward the park peripheries following the closing of the dumps. Researchers relate reduced litter sizes in grizzly bears to the loss of garbage in the diet. Human-caused mortality of grizzly bears increased after the dumps were closed (Craighead et al. 1995), and the grizzly bear population is reported to have declined from 1967 through 1980 (Craighead, Varney, and Craighead, Jr. 1974; Knight and Eberhardt 1985). By the mid-1980s, human-caused mortality of adult female grizzly bears had decreased and began to allow the grizzly bear population to increase again (Eberhardt and Knight 1996).

When whitebark pine seeds were available from 1977 to 1987, they were used almost exclusive of other foods (Craighead, Sumner, and Mitchell 1995). Meat, as prey or carrion, ranked second in the diet after the dumps were closed, although there was substantial difference in use of ungulates from year to year (Mattson, Blanchard, and Knight 1991). Forbs became more important in the bear diet after the dumps were closed and ranked third from 1977 to 1987. In fact, the grizzly bears appeared to compensate for the loss of garbage in the diet primarily through increased use of forbs, although the use of vertebrates (ungulates, specifically) and invertebrates also increased (Craighead, Sumner, and Mitchell 1995). Invertebrates ranked fourth in the diet, grasses and sedges ranked fifth, and fleshy fruits (berries) ranked sixth (Craighead, Sumner, and Mitchell 1995). Current information (Mattson 1997) suggests that ungulate meat is now playing an important part in the grizzly bear diet, and may be important in the late summer and fall (during the big game breeding season) as well as in the spring.

Other changes not related to the closing of garbage dumps have also either taken place or been discovered in the grizzly diet in recent years. The fires of 1988 reduced the whitebark pine canopy, and may have a long-term effect on the amount of pine seeds available to bears (Craighead, Sumner, and Mitchell 1995). Winter-killed ungulates have long been an important food source for bears in the spring, although field research indicates a decrease in the use of ungulate carrion from 1970–71 to 1980–82 (Craighead, Sumner, and Mitchell 1995). Spawning native cutthroat trout have become an important dietary component for some individual bears, and the use of fish increased from 1980 to 1990 (Craighead, Sumner, and Mitchell 1995). Grizzly bears in the Yellowstone area have recently (1986) been "discovered" to be feeding on army cutworm

moths in the late summer and fall at high elevations in Wyoming (Craighead, Sumner, and Mitchell 1995). Moths are now known to be a very important food of the seasonal diet for some bears.

Craighead, Sumner, and Mitchell (1995) conclude that the grizzly bear population of Yellowstone was nutritionally pressured rather than being nutritionally stable for at least a decade following the closure of the dumps.

Ungulate Availability as a Food Source for Grizzly Bears. The number of ungulates has increased dramatically since herd-reduction programs in the park ceased in the early 1970 (Mack and Singer 1992). The elk herd increased from less than 5,000 animals around 1968 to an estimated 14,000–16,000 on the northern winter range. The population of the interior elk herd (Madison-Firehole) has remained fairly constant at about 800 animals year-round (Craighead, Sumner, and Mitchell 1995). Bison also increased during this same time period from about 460 animals in 1961–68 to about 4,000 in 1994 (see table 13), and currently (September 1997) there are an estimated 2,200 bison in the Yellowstone area.

Grizzly Bear Use of Meat in the Diet. Grizzly bears will eat meat whenever it is available (Mattson 1997), and ungulates are an important part of the grizzly bear diet (Mattson, Blanchard, and Knight 1991). The percentage of meat consumed by grizzly bears has apparently been underestimated in fecal analysis (Pritchard and Robbins 1989; Mattson 1997). Meat is now considered to be one of the most important components of the grizzly bear diet in the Yellowstone area (Mattson 1997). As suggested by Robbins (pers. comm.), as much as 50% of the annual grizzly bear diet of Yellowstone bears may be meat, and that some bears' annual diets could be comprised of as much as 90% meat. Ungulate meat is the second highest source (following army cutworm moths) of net digestible energy for grizzly bears in the Yellowstone area at 6.0 kcal/g (Craighead, Sumner, and Mitchell 1995). Meat consumption is highest in spring and fall and lowest in June and July.

From 1977 to 1992, 53% of the ungulate meat consumed by Yellowstone grizzlies was from elk, 24% from bison, 18% from moose, 4% from domestic livestock, and 1% from mule deer (Mattson 1997). The amount of moose and bison was 20 times and 3 times greater, respectively, than what would have been expected by the population size of either species. Bear use of ungulates appears to be more closely tied to amount and availability of carrion and the whitebark pine seed crop than simply to numbers of live ungulates. Ungulate use was 2.1 times higher in years of low use of pine nuts.

Most (70%) of ungulate meat consumed by grizzlies is in the form of carrion, although grizzlies do prey upon live ungulates as well. On average, an adult bear kills 1.4 to 5.8 ungulates per year. Predation plays a more important role in October (58% of ungulate meat) than from April to May (9%).

An important source of ungulate carrion is from road kills, which accounts for 16% of the meat consumed on average (Mattson 1997). The largest biomass consumed per carcass is from scavenged male bison, and the least from elk calves and mule deer. Only 4% of bison consumed is from predation.

Spring Food Habits of Bears. Green, Mattson, and Peek (in review) found spring use of carcasses was positively related to elevation and was lower near roads or recreational developments. The correlation with elevation may be related to the fact that grizzly bears den and are first active in the spring at higher elevations, and that fewer competitors for the carrion live at these elevations. Grizzly bear use of carrion is affected by the number of winter-killed ungulates on winter range. Variation in numbers of elk and bison that die on the winter range are likely to have the greatest effect on bears.

Grizzly bears more often used larger-sized carcasses as a source of carrion, and bison carcasses are used more frequently than elk. Other scavengers such as coyotes, black bears, and probably wolves tend to outcompete grizzly bears for ungulates that are less than 16 kg of edible biomass (Mattson 1997).

Use of Bison Carrion in the Bear Diet. Grizzly bears make use of available carrion, and when the number of bison increases, the proportion of bison carrion in the grizzly bear diet also increases, as shown in surveys in 1980–81 and 1985–92 (Craighead, Sumner, and Mitchell 1995). These surveys indicate the frequency of bison carcass use was much greater in 1985–92 (39.9% of the number available, or 258 bison carcasses) than in 1980–81 (26.1% of the number available, or 86 bison carcasses).

The same survey showed grizzly bear use of bison carcasses was greater in 1985–88 and 1990–91 when it was 52% of elk and 48.2 % of bison than in 1989 when it was only 16.5% of elk and 12.0% of bison (Craighead, Sumner, and Mitchell 1995). This was likely due to the flush of carrion available that spring after the fires of 1988 and a subsequent hard winter. During the 1960 to 1972 time frame, frequency of use of bison was 82.8% and of elk was 39.2%. This was probably due to the relative size and number of bison carcasses compared with elk carcasses and the apparent preference of grizzly bears for bison carcasses, as well as less competition with other scavengers for bison carcasses (Craighead, Sumner, and Mitchell 1995).

In the Firehole River drainage, the number of ungulate carcasses found varied from six in 1990 to 401 in 1989 (Mattson and Knight 1992). Bison that were least vulnerable to mortality in this area were from one to six years of age. Adult bison carcasses were used proportionally more often (92% of those available) than any other carcass type; however, carcasses of adult bison went unused if located near human facilities. Bears used adult elk least often (38%). In all years and areas, adult bison cows were the most consistently and heavily used by grizzly bears.

Competition for Carrion. Grizzlies dominate other scavengers at carcasses (Servheen and Knight 1990), but many carcasses get consumed prior to being found by a bear (Green 1994). Individual bears benefit if they can be the only consumers of an ungulate carcass. This is less likely as the ungulate body size increases. Individual bears are most likely to get their largest meals from adult moose and elk that are prey and from adult female bison that are scavenged (Mattson 1997).

Gray Wolf

The gray wolf was reintroduced into the Yellowstone area in 1995 and has the status of a nonessential, experimental population in this area according to section 10 (j) of the Endangered Species Act (1973, as amended). This means that the species is treated either as proposed for listing in the national forest or as threatened in the national park (50 CFR 17) for the purposes of several sections of the Endangered Species Act, including section 7 consultation.

Currently nine breeding pairs (as of 9/97) inhabit the Greater Yellowstone Area, mostly within the park boundaries. There are occasional forays by individuals and packs outside the park, but no wolves from the nonessential, experimental population are known to be denning outside the park in Montana at this time.

In the Yellowstone area, wolves feed on live and dead elk, deer, bison, and smaller mammals. Wolves rarely prey on live bison, but do eat bison carrion if it is available. By their large body size and pack social organization, the wolf is adapted to feed on large species of prey animals. Wolves are believed to play a beneficial role in removing sick or inferior animals from a herd through predation. They will prey on large ungulates such as moose, and, to some degree, bison (Mech 1970).

Due to their size and shape, bison in deep snow are vulnerable to wolves (Teller and Kelsall 1984). However, wolves are not expected to successfully prey on many bison on the northern winter range of Yellowstone because (1) there are alternate prey such as elk, which research has shown is preferred by wolves (Carbyn, Oosenbrug, and Anions 1993) and whose biomass and numbers greatly exceed that of bison, (2) snow depths are shallower on the northern winter range than the other winter ranges in and near the park (NPS, Meagher 1973), and (3) bison will fend off predators (Carbyn and Trottier 1987, 1988). Historically, bison in Yellowstone National Park may not have been heavily preyed upon by wolves (NPS, Meagher 1973).

It appears that wolves killing live bison in Yellowstone is a rare phenomenon, as only two incidents of this have been observed since wolves were reintroduced in 1995 (NPS, D. Smith, pers. comm., May 29, 1997). However, as their numbers increase, wolves may increasingly use bison as a prey source (Koth et al. 1990). Boyce and Gaillard (1992) modeled bison numbers after wolf reintroduction and projected an average bison population less than 15% lower with wolves than without wolves.

On December 12, 1997, the United States District Court for the District of Wyoming ruled that the gray wolf reintroduction program in Yellowstone National Park and northern Idaho violated certain provisions of the Endangered Species Act. The court ordered the federal government to remove the reintroduced wolves and their offspring. The court stayed the effect of the order pending appeals. Because the decision is on appeal, this document will consider the gray wolf as a permanent component of the study area. Should the decision be upheld on appeal and the wolves are removed, impacts on the gray wolf would not be an issue associated with bison management under the alternatives analyzed.

SENSITIVE SPECIES

Sensitive species do not receive the same degree of protection as endangered or threatened species, although decreasing numbers or loss of habitat makes them of concern to federal land management agencies.

Lynx

Although lynx are scarce in the Greater Yellowstone Area, there have been some documented occurrences (Nellis 1989). Lynx would not prey on bison, but may consume bison as carrion. This is expected to happen only rarely, as lynx normally consume snowshoe hares and occupy lodgepole pine forests in the winter when bison migrate to lower elevation range. Should a bison die in lynx habitat in the winter, its carcass may be consumed quickly by other carnivores, and can be fully used within a day or two of the bison death. Bison would therefore be only an occasional food source for the lynx (Meagher, pers. comm. 1993). Recently people petitioned to add lynx to the threatened and endangered species list. Listing of this species was found by the U.S. Fish and Wildlife Service to be "warranted but precluded" at this time. This finding indicates that the lynx could be classified as threatened or endangered in the next few years.

Wolverine

Wolverines are considered rare or scarce in the Greater Yellowstone Area. Wolverines inhabit high elevation conifer forests in the summer and move to mid or lower elevations in winter. Wolverines tend to avoid large openings, the preferred habitat of Yellowstone bison. The wolverine is an opportunistic carnivore and will eat whatever is available (Hash 1989). This species may occasionally use a bison carcass, but bison would not be a major food for the wolverine (Meagher, pers. comm. 1993). Wolverines den at high elevations and are very susceptible to human disturbance. It has been noted in several studies that wolverines have abandoned den sites in response to what was believed to be very minor disturbance (Copeland 1996).

Trumpeter Swan

This species may be affected by the location and operation of bison management facilities such as capture facilities or quarantine facilities. The swan occupies meadows and open fields, as well as lakes, ponds, or slow-moving water inside the park on the Madison River at Seven-Mile Bridge (see Alternative 6 map in "The Alternatives") and outside the park on the Madison arm of Hebgen Lake.

SENSITIVE AND SPECIAL CONCERN PLANT SPECIES

In addition to Ross' bentgrass (*Agrostis rossiae*) and Yellowstone sand verbena (*Abronia ammophila*), many other sensitive (as classified by the U.S. Forest Service) and special concern plants may occur within the area affected by the alternatives. The lists of these species are updated regularly by the Montana Natural Heritage Program, the Wyoming Natural Diversity Database, and the U.S. Forest Service. Plants do not maintain any Montana or Wyoming protective status. No plant species are discussed in this environmental impact statement because no general impacts are anticipated.

Specific impacts would be avoided through the siting criteria outlined in "The Alternatives" for capture and/or quarantine facilities on public land. These criteria include a site-specific survey and completion of biological assessments for threatened, endangered, sensitive, or other special concern species that may be affected. Surveys to determine the location of listed plants (or wildlife, if appropriate) would be conducted before the construction of capture facilities, quarantine facilities, or associated structures (such as fences and installing utilities). If threatened or endangered species would be affected by these facilities, they would be redesigned, moved, or their impacts otherwise mitigated.

The Yellowstone area is a diverse ecosystem, with 10 species of amphibians, 11 species of reptiles, 317 species of birds, 88 species of mammals, and 18 species of fishes.

The categories of species most likely to be affected by bison management are (1) other large ungulates, in terms of competition for food, (2) predators and scavengers, in terms of food base, and (3) species associated with bison grazing and behavior. A brief overview of these categories of species follows.

UNGULATES

In addition to bison, seven other large ungulate species exist in the affected area: elk, pronghorn, mule deer, white-tailed deer, bighorn sheep, moose, and mountain goats. Because there is little habitat overlap between bison and mountain goats (Chadwik 1983), they will not be addressed further.

Yellowstone supports large migratory herds of numerous ungulates due to its climate, geology, elevational and vegetational diversity, and its relatively undeveloped state. Differences in size, habitat preferences, food sources, tolerance of snow depth, and behavior likely minimize competition between species. Singer and Norland (1994) found that competition among ungulate species during a period following release from artificial controls was not great enough to curtail population growth of any species, although it is possible that growth rates of some species (except bison) were slowed.

In Yellowstone, as in most areas, winter is the critical time period for ungulates. Snow depth and density limit the amount of range accessible for use (Gilbert, Wallmo, and Gill 1970). The severity of the winters also makes ungulates more vulnerable to other stresses. Unfamiliar activity on winter range can be extremely draining on energy reserves compared to predictable and habitual activities, or to disturbances occurring during other seasons.

Elk

Management, Distribution, and Abundance. In Montana, elk are managed in elk-management units (EMUs). The area affected by bison management actions in this environmental impact statement includes three EMUs: the Gallatin, the Madison, and the Emigrant. The northern Yellowstone elk herd (approximately 14,000 to 16,000 animals) occupies winter and summer range within Yellowstone National Park. These elk winter in a 400-square-mile area from the Lamar Valley in the park west and north to the Dome Mountain Wildlife Management Area outside Yellowstone National Park. Elk are hunted outside the national park in all these EMUs, with a late-season hunt conducted in the area between Yellowstone's north boundary and the Dome Mountain area.

Ecology, Habitat Use, and Food Habits. Elk are versatile generalists (Houston 1982) and use a mixture of habitat types in all seasons. In winter they use primarily open grassland, in spring they use relatively open grassland with some timber, and in late summer and fall they use a variety of grassland and forest types. Where hunted, elk may use dense forest (Hamlin, pers. comm. 1994). Cole (1969) found that northern Yellowstone elk distribution in winter occurred along an elevational gradient in relation to suitable foraging areas, distribution of other elk, response to human disturbance, and weather variables. Elk select preferred plant species and plant parts during spring and summer, whereas winter grazing of grasses appears to be indiscriminant (Houston 1982). Grass comprises most of the elk diet in all seasons (see table 28). Elk can cope with a wide variety of deep and crusted snow conditions (Barmore 1980).

Table 28: Comparative Ungulate Habitat Use and Food Habits in the Yellowstone Bison Management Area

Species		Winter	Summer	Areas of Competition
Bison (NPS, Meagher, pers. comm. 1994)	Habitat Use	Open valleys, swales and sedge bottoms-snow may limit areas. Wide variety of sites.	Follow plant phenology-rest rotation grazing-open valleys-always on move-nomadic.	
	Food habits	Grass/Sedge 99% Forbs -- Browse 1%	Grass/Sedge 91% Forbs 6% Browse 2%	
Mule deer (Pac and Frey 1991; Singer and Norland 1994)	Habitat Use	Semiopen rugged foothills, sagebrush steppe, Douglas-fir interspersed with sage and juniper bunchgrass.	Open to moderately dense-canopy montane forest; follow greenup to higher elevation from wintering areas.	Some habitat overlap but no evidence of competition for food.
	Food Habits	Grass - 20% Forbs - 15% Browse - 65%	Grass - 5% Forbs - 80% Browse - 15%	
White-tailed Deer (MT DFWP, Dusek, pers. comm. 1994)	Habitat Use	Agricultural/riparian	Intermittent wooded hardwood drainages	No evidence of competition for food; some overlap in habitat use, especially in bison movements out of park-displacement.
	Food Habits	Grass - Negligible Forbs - Negligible Browse - High Detritus - High	Grass - Negligible Forbs - May 30 - July Browse - Deciduous species-leaves	
Pronghorn Antelope (Scott 1994; Goodman 1996)	Habitat Use	Sagebrush shrublands-flats	Open grasslands, shrubfields, and forest edges at all elevations	Winter range overlap in Stephens Creek area.
	Food Habits	Grass 4% Forbs 14% Browse 82% (Rabbitbrush, winter fat, greasewood)	Grass 7% Forbs 38% Browse 54%	Sagebrush in winter, distinct from bison food preferences.
Bighorn Sheep (Irby et al. 1971; Singer and Norland 1994)	Habitat Use	Lower open grasslands near rocky outcrops	Open grassland-edge of timber at higher elevations	Some spatial overlap, but separated by diet, tolerance of snow.
	Food Habits	Grass 55% Forbs 10% Browse 35%	Grass 50% Forbs 36% Browse 14%	
Elk (Houston 1982)	Habitat Use	Open grassland	Open to dense forest by August and September	Mixture of habitat types, similar to bison; low to moderate food overlap.
	Food Habits	Grass 80% Forbs 10% Browse 10%	Grass 60–65% Forbs 30% Browse 5–10%	

Areas of Competition With Bison. Singer and Norland (1994) found a low to moderate degree of diet overlap between bison and elk, although the two species share a high degree of habitat overlap. During a period in which both species increased rapidly following release from artificial control, neither bison nor elk appeared to suffer any decrease in population growth due to competition from the other species. It is possible that stimulation of production and nutrition in grasses may have resulted in a beneficial effect for both species at observed population levels (Singer and Norland 1994).

Pronghorn Antelope

Management, Distribution, and Abundance. The pronghorn antelope (known simply as pronghorn) population in the affected area numbers approximately 220 animals. This population has experienced a major decline in recent years, dropping from a high of nearly 600 pronghorn in 1991 to the present level. Goodman (1996) has indicated that this pronghorn population is at a high risk of extinction within the next 100 years. Pronghorn winter range is restricted to approximately 2,900 ha (7,168 acres), 75% of which is within Yellowstone National Park. This area is located between Mammoth Hot Springs and Cinnabar Mountain, with the core use area in the predominantly open grasslands near Stephens Creek. Approximately 25% of the pronghorn population migrates to summer range on the Blacktail Plateau and in the Lamar Valley (D. Scott, unpub. data). Periodic depredation hunts have been conducted on private land adjacent to the north boundary of the park, with harvests ranging from 2 to 37 animals.

Ecology, Habitat Use, and Food Habits. The Yellowstone pronghorn population contains unique genetic elements, and has been shown to have greater genetic variability than many other pronghorn populations (Lee, Bickham, and Scott 1994). The cause of the recent population decline is unknown, but possible contributing factors include predation, winter habitat quality, human-caused mortality, and competition with other ungulate species on winter range. Scott (unpub. data) suggested that coyote predation may be the cause of 90% of pronghorn fawn mortality, and coyote predation has been implicated as a source of mortality in adult pronghorn as well. Of all the ungulates native to the Greater Yellowstone Area, pronghorn are least able to cope with deep snow. Sagebrush is an important food item for pronghorn, with forbs and grasses making up a significant portion of their diet (Singer and Norland 1994). Sagebrush may be important in winter both as food and as shelter from severe weather. Because running from danger, over sometimes long distances, is the pronghorn's major defense against predation, they require suitable forage distributed over a large area in both summer and winter ranges (Pyrah 1987). Pronghorn appear to be less able to successfully cross fences than most other ungulates (BLM, USDI, Yoakum 1980). Pronghorn may also be quite vulnerable to harassment by humans (Autenreith 1983).

Areas of Competition With Bison. Yellowstone bison and pronghorn are separated by habitat selection, food habits, snow tolerance, and seasonal distribution (Barmore 1980; Singer and Norland 1994). Bison and pronghorn winter ranges overlap in the Stephens Creek area of the park.

Deer

Management, Distribution, and Abundance. Mule deer and white-tailed deer are both found in and adjacent to Yellowstone. White-tailed deer, however, were quite rare in the park in the early historical period (Schullery and Whittlesey 1992), and few currently summer or winter in the park. White-tailed deer numbers increase with increasing distance from the park boundary and become more numerous along major riparian areas and river drainages north and northwest of Yellowstone National Park. Small numbers of white-tailed deer winter in thickets along the lower Gardiner River and along the Yellowstone River in and adjacent to the park (Barmore 1980). Viable populations occur in dense contiguous thickets along the Yellowstone River beginning about 19 miles (30 km) north of the park. White-tailed deer winter along the

Madison River, and a few winter in the Hebgen Basin, which is described as good summer range (MDFWP, unpub. data). Currently no estimates are available of the number of white-tailed deer in the northern Yellowstone area, but they appear to exist at very low population levels (MDFWP, T. Lemke, pers. comm., 1997).

Mule deer are the primary deer species found in and adjacent to Yellowstone. Mule deer in the northern Yellowstone National Park area winter predominantly along the Yellowstone River valley to the north of the park boundary. Mule deer winter range also includes the Gallatin River valley and neighboring foothills, and the edge of mountain slopes in the Madison Valley. Many of the mule deer wintering in these areas summer in the high elevation mountains throughout the northern Yellowstone National Park area.

The northern range mule deer population has been decreasing in recent years. In May 1997 biologists conducting an aerial survey counted 1,748 mule deer. This is the second lowest count in 11 years of aerial surveys (MDFWP, T. Lemke, unpub. data).

Ecology, Habitat Use, and Food Habits. While-tailed deer occur in mesic and more forested habitats within the affected area, preferring thickets and cottonwood stands along river valleys, and other areas of relatively dense cover. They consume mostly browse and some forbs.

Mule deer occur in more open, xeric portions of the study area. Houston (1982) observed that mule deer used xeric steppe, sage steppe, and mesic steppe on 80% of feeding observations in the park. Sagebrush steppe is very important to mule deer outside Yellowstone National Park, although Barmore (1980) indicated that use of Douglas-fir is underestimated throughout the area. Mule deer are found in semiopen rugged foothills in winter, and in spring they follow greenup adjacent to foothills. In summer and fall they use open to moderately dense canopy and montane forest, depending on hunting pressure (MDFWP, H. Pac, pers. comm. 1994).

Areas of Competition With Bison. There appears to be little, if any, habitat or diet overlap between white-tailed deer and bison. Although bison and mule deer experience some degree of overlap in habitat use, there appears to be little or no competition between these two species because of differing diet preferences (Singer and Norland 1994). Competition may also be precluded by seasonal distribution differences and by the limited ability of deer to deal with deep snow (Barmore 1980).

Bighorn Sheep

Management, Distribution, and Abundance. Approximately 150 bighorn sheep occupy portions of the affected area. An additional 40–50 bighorn sheep occupy two ranges north of the area (MDFWP, T. Lemke, unpub. data). An outbreak of chlamydia in the early 1980s resulted in a rapid decline in bighorn sheep numbers, from which the population appears not to have recovered (Legg 1996). The 1997 count represents a decrease of about 13% overall from the previous year. Although bighorn sheep wintering ranges inside and outside the park appear to be quite distinct, recent research has demonstrated that there is some degree of mixing of subpopulations (Legg 1996). Therefore, all bighorn sheep in the northern Yellowstone area, both inside and outside the park, should be considered part of a contiguous population. A limited, special-drawing hunt is conducted for bighorn sheep in the area outside the park.

Ecology, Habitat Use, and Food Habits. Upland grassy habitat accounts for 60%–80% of observations of feeding bighorn sheep (Houston 1982). Bighorn sheep traditionally use steep slopes and ridgetops, and can occupy high elevation windswept cliffs (Barmore 1980). In spring they follow greenup to higher elevations, and in summer and fall use open grasslands and timber edge areas at higher elevations (see table 28). Grasses comprise approximately 58% of bighorn diets, with shrubs and forbs as additional important diet components (Singer and Norland 1994). In winter, bighorns use

lower elevation, open grasslands near rocky outcrops. Proximity to escape terrain appears to be a primary factor in bighorn sheep habitat selection (Legg 1996), although some groups of 10–20 or more rams often feed far from cliffs on grasslands near the Yellowstone and Gardiner rivers (Houston 1982). Bighorn sheep appear to be particularly vulnerable to a variety of diseases that can have adverse effects on individuals and on the population as a whole.

Areas of Competition With Bison. While there has been some increase in habitat overlap between bighorn sheep and bison in recent years (Singer and Norland 1994), the two species are separated ecologically by differences in distribution, diet, and tolerance of snow. During spring, bison increasingly select habitats with characteristics important to bighorn sheep, but there does not appear to be an appreciable degree of overlap in use of those areas.

Moose

Moose exist in small numbers in the northern portion of Yellowstone National Park and vicinity and are known for their ability to winter in deeper snows that other ungulates. They are most common in the Cooke City and West Yellowstone areas and tend to use riparian habitats. Moose and bison are not likely to compete for forage.

Recent research has shown that *B. abortus* may be fatal to moose (Forbes, Tessaro, and Lees 1996). Other studies indicate that brucellosis may not be a threat to moose (Zarnke 1993). In Grand Teton National Park where bison with brucellosis and moose co-exist, no one has observed a decline in moose population that can be attributed to the disease.

PREDATORS AND SCAVENGERS

Mammalian predators and scavengers that are potentially present in the affected area include grizzly bears, wolves, black bears, mountain lions, coyotes, foxes, wolverines, bobcats, and a variety of smaller mammals. Avian predators and scavengers include bald eagles, golden eagles, ravens, magpies, and several smaller bird species. Specialized scavengers also include a variety of insect species. Impacts on grizzly bears, wolves, wolverines, lynx, and bald eagles are analyzed in the chapter on "Impacts on Threatened, Endangered, and Sensitive Species."Because of their size and social organization, healthy bison of all ages would be difficult prey even for large predators (Fuller 1962). Scavengers in the Greater Yellowstone Area, however, rely heavily on carcasses of bison and elk for both winter and early spring food. Although the number of winter-killed bison varies from year to year (Gunther et al. 1997), carcasses are likely to occur in predictable locations. Some scavengers may have learned to rely on those locations to provide food during the period from late winter through early spring.

SPECIES ASSOCIATED WITH BISON GRAZING AND BEHAVIOR

Large numbers of bison can physically alter environments. Bison rub trees and saplings, debarking and sometimes killing them (NPS, Meagher 1973). It has been suggested that this activity may impede or even prevent forest invasion of open grasslands (NPS, Meagher 1973; J. Shaw, pers. comm. 1997). Grazing may also maintain open grassland communities by preventing accumulation of dead grass litter that would otherwise suppress growth of grasses (T. Baumeister, pers. comm. 1997). These physical impacts, in combination with the previously mentioned stimulation of productivity in grazed areas, are likely to help maintain open grasslands that are important to many other species. Historically, prairie dog distribution in the U.S. overlapped completely with bison distribution (J. Shaw, pers. comm. 1997). It is likely that burrowing rodents benefit from disturbances created by bison trampling and wallowing. Trampled areas and wallows, however, may also provide opportunities for invasion by nonnative vegetation, and may contribute to soil and streambank erosion.

HUMAN HEALTH

Brucellosis is a zoonotic disease that can infect people working with infected tissues or fluids, causing undulant fever. Symptoms include intermittent fever, chills, night sweats, body and joint pain, poor appetite, and weakness. Undulant fever can be caused by several different species of bacteria including *Brucella suis* (found in swine), *B. melitensis* (found in goats), *B. abortus* (found in cattle, elk, and bison) and vaccines containing live bacteria (Strain 19 and RB51).

Historically, people who have been at greatest risk for undulant fever are those who tend infected livestock, especially during birth or abortion events; veterinarians who work with pregnant animals or who vaccinate livestock; people who work in abattoirs (slaughterhouses); and people who consume unpasteurized dairy products and raw organs that have been contaminated and not properly prepared.

Risk of transmission to people is dose-dependent. People generally become infected either through exposure to tissues with large quantities of *Brucella* organisms, e.g., infected reproductive tissues, or frequent, multiple exposure to tissues and fluids with smaller quantities of bacteria. Subsequent transmission of brucellosis from person to person is unlikely.

Prompt and accurate diagnosis is essential for effective treatment of human brucellosis. Accurate diagnosis may be complicated because early symptoms are similar to those for several other diseases. Moreover, with progress toward the eradication of brucellosis, many physicians are not familiar with the disease.

As a part of all alternatives, the agencies would employ a number of standard practices, including routinely advising everyone who is potentially at risk for exposure to the disease of appropriate precautions and the symptoms of the disease. Veterinarians or others who work with bison carcasses would take standard measures such as wearing gloves, masks, and protective eyewear. Laboratory workers may also wear protective clothing. Slaughterhouses should be well ventilated, and workers should wear gloves, masks, and eyewear, although enforcement of these measures for slaughterhouse personnel is beyond the ability of the agencies. Hunters would receive training on the disease and appropriate precautions. All who work with open carcasses or tissues would be advised of health risks and appropriate safety measures. This information also would encourage people who manifest these symptoms to seek immediate medical attention and to advise their physicians that they may have been exposed to brucellosis.

Visitors to Yellowstone National Park and the analysis area may also be subject to injury from car collisions, either with bison crossing roads or with other cars whose passengers are stopping to view bison. Bison may be dangerous and can charge and gore people if approached too closely.

HISTORY

The Great Plains and the northern Rocky Mountains of western Montana and Wyoming served as home for bison. This region is also the homeland of various native peoples who hunted these ranging herds. Archeological evidence within Yellowstone National Park places earliest human occupation at 11,000 years ago (although some tribes believe they have occupied the lands much longer). No less than 10 tribes dwelled in the Yellowstone area during both historic and prehistoric times. Those tribes whose traditional territory falls within the Yellowstone area include the Crow, Eastern Shoshone, Salish and Kootenai, Shoshone-Bannock, Blackfeet, Nez Perce, Northern Arapaho, and the Northern Cheyenne Tribes (Turek 1994, 2-4).

For many the Yellowstone area contained hunting grounds. As late as the l880s, a band of Shoshone known as the Sheepeaters occupied portions of what is now Yellowstone National Park. Currently a few tribes claim hunting rights within the national park; the Shoshone-Bannock, who roamed the western portion; the Crow, who traversed the east; and some First Nations of Canada (Blackfoot, Blood, Piegan, and Assiniboine), who also hunted in the region (Waldman 1985, 187).

Treaties allowed the use of lands within the Yellowstone area by various tribes. Prior to 1872 the areas now known as Yellowstone National Park, Gallatin National Forest, Bridger-Teton National Forest, and Shoshone National Forest were reserved for some Plains tribes. The land west of the Yellowstone River was used traditionally by the Blackfoot, land to the southeast was part of the historic Crow territory, and the lands near the upper Missouri River constituted a common hunting ground for the above-mentioned as well as the Piegan, Blood, Gros Ventre, Flathead, Upper Pend d'Oreille, Kooteniai, and the Nez Perce Tribes according to the 1851 Treaty of Fort Laramie. Seventeen years later, the 1868 Fort Laramie Treaty removed many acres of Yellowstone area land from tribal control but allowed for hunting in "unoccupied" lands. Shoshone and Bannock

Shoshone Indians, by William Henry Jackson, 1871. (NPS photo)

treaties did not include reference to the Yellowstone area, yet they lived and hunted there until the end of the 19th century (Turek 1994, 2–4).

Bison were critical to the indigenous cultures of North America and were an important part of the landscape covering over half of the continent. They once ranged from the Appalachian Mountains to the "deserts" of the Great Basin south into Mexico and as far north as the Yukon territory in Canada. English settlers arriving in what is now Georgia wrote of the "innumerable" bison they encountered. The numbers were so great that early Euro-American explorers could only describe them as "numberless," and wrote that the plains were "black and appeared to be moving" with the herds of bison. The most commonly used estimates of their numbers were between 30 and 65 million.

Bison provided food, clothing, fuel, tools, and shelter, and were central to Plains tribal spiritual culture. Bison were viewed as an earthly link to the spiritual world. For many tribes, bison represent power and strength. For example, the Shoshone believe that spiritual power is concentrated in the physical form of the bison. Many contemporary tribes maintain a spiritual connection with bison.

Horses, brought to the Americas by Europeans in the 16th century, made the hunting of bison far more efficient. Europeans introduced a radically different notion of land use that emphasized resource-dependent, extractive industries. Consumptive use of land and its resources and the subsequent killing of the bison herds helped to alter the interrelated world of both tribes and bison.

The near extermination of the American bison did not occur in a few short, violent years. Bison populations already had begun to decline in the 1820s. This was accelerated as a result of years of drought in the 1840s. By the 1890s, increased numbers of domestic cattle competing for limited forage and intense hunting, which reflected a global market demand for buffalo robes and buffalo tongues, reduced the number of bison to slightly more than 300. Some believe cattle-borne contagious diseases in 1881–82 were a greater cause than hunting in the decline of the bison populations (Malone, Roeder, and Long 1991).

Buffalo bones at Buell, 1885.

Many Americans believed that the bison had completely vanished from the American landscape, along with the indigenous peoples. Both were memorialized on the nickel in 1913 (Waldman 1985, 219). While private herds existed throughout the U.S., by 1902 no more than 23 individual bison remained of the thousands that had occupied the Yellowstone area since prehistoric times (Callenbach 1996).

On the heels of the near-destruction of the bison, some Americans were determined to preserve what remained of the herds. Prior to the formation of the American Bison Society in 1905, its honorary president, Theodore Roosevelt, had persuaded Congress to establish a number of wildlife preserves. Also the creation of the nation's first national park helped protect the remaining bison. Concerns that the small wild herd might vanish, park managers imported 21 bison from captive herds in Montana and Texas into the park. From 1902 to about 1915 the imported bison were raised using livestock techniques in the "Buffalo Ranch" in Lamar Valley. They were fenced, fed, and separated for shipment to slaughter. The native population was not managed or fenced and was allowed to increase on its own (NPS, Meagher 1973). After about 1930, management moved from ranching bison to preservation of bison in a more natural state although vaccination and herd reductions

occurred within the park to varying degrees until 1968 (NPS, Meagher 1973).

The herds of the Yellowstone area are of special importance as the last remnant of the indigenous wild herds in North America (UC Davis, Van Buren, pers. comm. June 25, 1997). Some other bison herds, such as the Henry Mountain herd in Utah, are direct descendants of the Yellowstone herd. As bison continue to inhabit the landscape of what remains of the western frontier, a part of the unique American experience is preserved for future generations.

LIVESTOCK AND AGRICULTURAL INFLUENCES

The Montana Territory was greatly changed by the introduction of domestic livestock. While the trade of cattle from Montana did not prosper until the gold rushes of the 1860s, cattlemen were found in the Montana Territory before this time. They include Jesuit missionaries and other small producers. These producers found new local markets for beef with the existence of mining camps and military facilities. These markets led to more livestock being brought in through cattle drives from other areas of the nation. For example, Nelson Story drove the first Texas longhorns into Montana in 1866.

When Montana producers were raising more livestock than could be consumed locally, they looked for new markets which included Wyoming, Utah, and Canada. Some of these new markets were the result of economic development activities due to the construction of railroad lines in other states and Canada. One of the first long drives of Montana cattle to new markets took place in 1868. In addition, new world markets were formed. New urban populations in America and Europe resulted in an increased demand for beef. These new markets and the increased demand for cattle are factors in the decrease in bison herds due to the rise in the amount of livestock grazed on lands within Montana, which were used by bison.

The increased amount of livestock, the increased economic importance of this new industry, and the presence of disease resulted in the 1885 Montana Territory legislature authorizing "a territorial veterinary surgeon who had the power to quarantine cattle" (Malone, Roeder, and Long 1991).

AFFECTED CULTURAL RESOURCES

Archeology

Traditional use of bison by humans centers on hunting and is evidenced in the archeological record. The remains of drive lanes, chipping stations, wickiups, and weapons are all associated with the importance of hunting bison for tribal economy and culture.

Less than 2% of Yellowstone National Park's 2.2 million acres and a small percentage in the project areas of Gallatin National Forest have been archeologically surveyed. Approximately 850 prehistoric and historic archeological sites have been recorded to date within Yellowstone National Park. The sites contain evidence of hunting and gathering, trails, obsidian quarries (most notably Obsidian Cliff, a national historic landmark), hearths, base camps, stone for manufacturing, rock shelters, and stone circles.

Historic archeological sites present are representative of both Indian and Euro-American cultures, the latter including early hunters, miners, ranchers, U.S. military occupation, and park administration. Historic archeological sites include remains of transportation routes, farming and ranching operations, remains of buildings, pastures, cultivated fields, irrigation ditches, and the ruins of the town of Cinnabar.

The range of alternatives considers a number of areas for possible construction of new facilities. Any areas ultimately selected for construction would need to be archeologically inventoried to locate sites and evaluate them for inclusion in the National Register of Historic Places before determinations of effect can be made for each alternative.

Historic Structures

The greatest number of historic buildings and structures within the analysis area are located in Yellowstone National Park and are associated with civilian activities (1872–1886), U.S. military occupation (1886–1918), and NPS administration (1918–present). None of the buildings and structures is considered to be within the area of potential effect. The Yellowstone road system, which includes the Grand Loop Road and five entrance roads, has been nominated for inclusion in the National Register of Historic Places. While alternative 2 considers no grooming or closure of sections of certain roads to bison use, neither would change the character or overall condition of the circulation system.

Cultural resources within Yellowstone National Park and the Gallatin National Forest are managed to maintain their scientific, social, and historical value in compliance with all applicable federal and state laws (*Gallatin National Forest Plan,* p. II-3). Near the Reese Creek area, archeological and historic structure inventories were conducted by the U.S. Forest Service and the National Park Service. No national register eligible or listed archeological resources were located and no historic structures exist. In West Yellowstone, the U.S. Forest Service conducted archeological and historic structure inventories in some of the areas of effect, and no national register eligible or listed archeological resources or historic structures were located.

Ethnographic Resources

The ethnographic record for Yellowstone National Park and project areas of Gallatin National Forest is incomplete. An ethnographic overview and assessment is being developed for Yellowstone National Park. As funds become available, agencies anticipate conducting site-specific ethnographic research in consultation with affiliated Native American tribes. Yellowstone National Park consults with several affiliated tribes with lands near the Yellowstone area. These include the Nez Perce Tribe and the Shoshone-Bannock Tribes of the Fort Hall Reservation in Idaho; the Blackfeet and Northern Cheyenne Tribes, the Salish and Kootenai Tribes, and the Crow Nation in Montana; and the Eastern Shoshone and Northern Arapaho Tribes of the Wind River Reservation in Wyoming.

Cultural Landscapes

Cultural landscapes in Yellowstone National Park and Gallatin National Forest have not yet been formally inventoried or evaluated for national register eligibility. A cultural landscape is a geographic area, including both cultural and natural resources, that is associated with a historic event, activity, or person that exhibits other cultural or aesthetic values. Four different landscape types may be found in Yellowstone National Park, Gallatin National Forest, and the Yellowstone area — historic vernacular, specific historic sites, historic design, and ethnographic landscapes.

While landscapes are not fixed in time and continue to evolve, they maintain certain character-defining features that make them distinctive. Many Yellowstone area landscapes and viewsheds have changed over time and retain various degrees of historical integrity. Within the Greater Yellowstone Area, the bison constitute an important element of these landscapes. For further discussion of landscapes, see the "Visual Resources" chapter.

Montana ranch within the Greater Yellowstone Area.

Visual resources consist of landform (topography and hydrology) and land cover (vegetation, buildings, roads, etc.). Visual resources are centered on significant and intrinsic features. Assessment of visual resources also includes visibility of the proposed undertaking, such as exposure and location, in relation to current viewsheds. Yellowstone bison are an important part of the visual resources. They have existed within the Yellowstone area for centuries and remain the only herd to continuously occupy their original rangeland. The bison herd is a characteristic element of the viewshed.

LANDSCAPES AND VIEWSHEDS

Visitors to and residents of the Greater Yellowstone Area have many opportunities to experience various landscapes and viewsheds that make up the visual resources. This area is world renowned for its scenery, wildlife, wilderness, rivers, and geologic and thermal features. The area contains high elevation mountains and riverbed valleys. There are steep mountain walls, clear-running streams, geothermal formations, and mountain prairie grasslands. The landscape consists of both natural and cultural elements. Yellowstone National Park, Gallatin National Forest, other public lands, and surrounding communities contain infrastructure such as roads, turnouts, rural housing, campgrounds, and groups of administrative and concession buildings. The landscape is rugged and formidable due to the rapid rises in elevation, and most of the area remains in a natural state. Bison and other wildlife are frequently observed on the landscape.

PUBLIC LANDS

Visual resources within Yellowstone National Park fall into two general zones: the natural zone and the park development zone. The natural zone encompasses those lands classified as wilderness in the *Wilderness Recommendation* of 1972, which applies to 90% of the park. The viewshed in this zone is characterized by primeval nature, lack of facilities, and low-level visitor use. The development zone makes up the remaining 10%, and is broken down into two broad categories: developed areas and transportation corridors (NPS 1992). Bison are observed within both zones, although they are mostly within the natural zone. Generally, people in the developed zone are able to observe bison in the natural zone.

Vehicle pullouts within Yellowstone National Park are designed specifically for visitors to stop and experience the visual resources, including bison and other wildlife. Thus, many of these pullouts are placed in areas where bison are most frequently found, in valley lowlands off the main roads. Some locations include the open areas within Hayden Valley, the Old Faithful/Firehole area, the Madison River (past Seven-Mile Bridge), Indian Creek in the Mammoth area, the Norris Campground, Gibbon Meadows, Elk Park, and others. The view from these pullouts is an unobstructed natural setting containing habitat desirable to bison as well as other wildlife species.

National forest land use is managed to maintain specific visual quality objectives or a level of scenic quality and diversity of natural features based on physical and sociological characteristics of an area. Project areas contain national forest lands with visual quality objectives ranging from preservation to maximum modification. "Preservation" allows only ecological changes; "retention" means that human activities are not evident to the casual visitor; "partial retention" allows evidence of human activity if it is subordinate to the characteristic landscape; "modification" means that human activity may dominate the land but should appear as a natural occurrence, and "maximum modification" allows human activity to dominate, yet it should appear natural when viewed as background (*Gallatin National Forest Plan*, p. VI-44).

In the Gardiner area, forest lands are managed for recreation, livestock, big game winter habitat, timber harvest, and wilderness within which the visual quality objectives are primarily focused on preservation, partial retention, and modification. The West Yellowstone lands also support recreation, livestock, and timber harvest as well as forest operations, electrical corridors, heavily used public areas, and research areas. The visual quality objectives accommodate modification, partial retention, and retention. Near Cooke City, national forest lands accommodate a combination of recreation, livestock, timber harvest, and wilderness with portions that have heavy public use and mining operations. This area contains visual quality objectives primarily focused on partial retention and retention, with pockets of preservation and maximum modification (USFS, Jane Ruchman, pers. comm. July 1997).

BISON MANAGEMENT ACTIVITIES

Residents and visitors who view bison management operations in the analysis area currently include primarily the approximately 100 persons living near the West Yellowstone area as well as accidental or intentional observers in the Stephens Creek area. Bison management activities include hazing, capture, testing, agency shooting, and shipment to slaughter. Future actions may include hunting or quarantine, depending on the alternative selected.

Visible hazing activities that may have an adverse impact on visual resources include herding bison by helicopter, by vehicle, and on horseback or foot; shooting with rubber bullets; and possible use of dogs. Various hazing activities affect visual resources and quality for residents and visitors in the Yellowstone area. Hazing is visible from roads and lands near areas where bison leave the park and enter other public or private lands. Most hazing activities occur outside the park as needed. In addition under state law, the Department of Livestock is required to remove the bison from private property if requested by the property owner. Capture and test facilities are visible from the county road in the Stephens Creek area and from a few residences in the West Yellowstone area. Activities such as testing and tagging are not visible due to the solid high walls, except for the initial herding and final loading operations. The solid walls are used to facilitate the handling of bison within the facilities.

Some agency shooting is visible in areas where bison leave the park boundary. Current exit locations include the Yellowstone River drainage basin near Stephens Creek and Gardiner and near West Yellowstone by way of the Madison Valley. Agency shooting is undertaken mostly in the morning hours, as needed, depending on bison out-migration. After bison are shot, they are towed to a central location to be processed and transported to carcass recipients. In West Yellowstone the act of dragging bison across the snow results in highly visible trails of blood. This does not occur in the Stephens Creek area because of the limited or absence of snowfall; thus, blood trails are less visible. The entrails are occasionally piled up as carcasses are processed (amount depends on processing volume) and may remain until proper disposal is arranged by truck or bucket loader. Reproductive organs are immediately disposed of by agency officials because they pose the highest threat in the spread of brucellosis to humans and domestic livestock.

Shipment of bison to slaughter requires large transport vehicles, which are visible in the Yellowstone area and along highways leading to the slaughter facilities within a 160-mile radius from the northern and western park boundaries.

ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

The following chapters discuss the environmental impacts of each of the alternatives on natural, cultural, and other resources of concern. The degree of impact can be quantified in some cases, such as when a model is used or data are obtainable. However, often only qualitative descriptions of impact are available. The following definitions are applied throughout the environmental impact statement:

- Negligible – the impact is at the lower levels of detection.
- Minor – the impact is slight, but detectable.
- Moderate – the impact is readily apparent and has the potential to become major.
- Major – the impact is severe, or if beneficial, has exceptional beneficial effects.

SUMMARY OF REGULATIONS AND POLICIES

Several recent planning and policy documents, including the *Yellowstone National Park Master Plan* (NPS 1974), the *Yellowstone National Park Statement for Management* (NPS 1991), and the *National Park Service Management Policies* (NPS 1988), require the protection of ecological processes and native species in a relatively undisturbed setting, and prescribe that park planning be accomplished in a regional context. This latter concern is summarized in the *Management Policies* as follows: "Recognizing that parks are integral parts of larger regional environments, the National Park Service will work cooperatively with others to anticipate, avoid, and resolve potential conflicts, to protect park resources, and to address mutual interests in the quality of life for community residents, considering economic development as well as resource and environmental protection."

When bison leave Yellowstone National Park, they are no longer within the jurisdiction of the National Park Service, and management is governed by Montana statutes (81-2-201 M.C.A., 81-2-120, M.C.A; and, 87-1-216, M.C.A.). These laws define bison that originate from Yellowstone National Park as "a species requiring disease control." In combination with the mandates of the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, brucellosis-infected bison originating from Yellowstone National Park are not permitted to freely roam in Montana.

METHODOLOGIES FOR ANALYZING IMPACTS

Population Estimates

Bison population changes were estimated using both the scientific literature and predictive models based on that literature.

First, a review of relevant literature was conducted to determine a population range within which to base analyses of management actions on the bison population. Green herbaceous vegetation (Merrill et al. 1988) and winter severity have been used in stochastic (e.g., based on frequency of random events, such as winter mortalities and weather conditions) and deterministic (e.g., using an averaging approach) population models to predict bison numbers within Yellowstone National Park (Boyce 1990; Boyce and Gaillard 1992). Based on average forage production, winter severity, and other factors, Yellowstone National Park will support a long-term average of 2,700 bison. However, weather and forage production are quite variable and, correspondingly, the maximum herd size fluctuates between 1,700 and 3,500 (Boyce 1990; Boyce and Gaillard 1992). The low end of the range would result from effects of harsh winters and poor annual forage production, with the high range representing bison numbers after a series of mild winters and high annual forage production. For all alternatives except alternative 7 (where the upper limit is lower), population numbers were assumed never to exceed 3,500 because of random, periodic environmental events (poor forage production, severe weather) bison emigration, and the agencies' increasing levels of lethal control of bison (or removal to quarantine) at higher population levels.

A first step in the quantitative analysis was to construct a basis for estimating the expected early winter bison population for 1997. The spring bison population was estimated at 1,900 based on aerial counts. Based on findings from the 1960s (NPS, Meagher 1973) and 1980s (Pac and Frey 1991) the bison male/female ratio was 57/43. Using this ratio, the spring 1997 female component of the population was estimated at 817 animals.

Calves and yearlings do not produce calves (NPS, Meagher 1973; Kirkpatrick et al. 1996). Results from data collected during four winters

between 1988 and 1997 showed that calves and yearlings comprised an average of 40% of total female bison killed (Pac and Frey 1991; Aune, unpub. data). Using these data, approximately 60% of the female component, or 490 bison, would be of reproductive age and capable of producing calves.

Calf production for the Mary Mountain and northern range subpopulations was observed at 42.6% and 52.6%, respectively (Kirkpatrick et al. 1996). Using a 52% calf production value, approximately 255 calves would be born, and assuming no additional calf mortality the 1997 early winter population is estimated at approximately 2,156. This number was used as a beginning population for the analysis. This number closely approximates the 1997 early winter aerial counts of approximately 2,200 bison.

Bison with nursing calf.

The next step in the analysis was to construct a simple deterministic (averaging) population model that included estimates of the rate of change in the population, taking management actions into account, and estimates of changing seroprevalence rate. The rate of increase was calculated using the rate of change between the late winter population, after management removals and natural mortality, and the fall high population count for the following year (Eberhardt 1987). Early winter bison population counts and removals (Meagher, unpub. data; National Park Service and State of Montana 1996; National Park Service, unpub. data) from 1979 to 1997, when the population ranged between 1,700 and 3,500 animals, were used to calculate the rate of change for the bison population (see table 29). The geometric mean of the rate of change was calculated to be 1.082 (see table 29); this means the bison population increased at an average rate of 8.2%/year over this time period. This rate was validated using actual population counts through 1996.

Based on management removals from 1984–85 to 1995–96, an average of 5.1% of the total early winter bison population exited Yellowstone National Park into the Reese Creek area north of the park and the West Yellowstone area west of the park (see table 29). The 5.1% value was used in the model to calculate the average total number of bison exiting the park each year. Past data indicate that after large removals in the Reese Creek area, few bison exit the north boundary area for approximately two years. This trend is expected to continue, and very few or no bison are expected to exit to the north boundary area prior to 1999. Based on the large number of bison removed from the Reese Creek area in the winter of 1996–97, the model assumed no bison would exit the Reese Creek area until 1999. Bison were assumed to exit the park during winter at the West Yellowstone area for all years in the model. Comparing total removals across all years, 65% of the total bison removed were from the Reese Creek area, and 35% were from the West Yellowstone area. These ratios were used in the model to estimate the proportion of bison exiting at the two areas. Average numbers of bison entering the Eagle Creek/Bear Creek area in the winter are unknown, but it was assumed approximately 100 would inhabit this area.

The model used the above assumptions to calculate average population growth, the average number of bison leaving the park by area, and predictions of population size based on specific management actions. A minor increase or decrease in population size is defined for purposes of analysis as less than 10%, a moderate change is 11%–20%, and a major change is greater than 20%. Methods and assumptions used to calculate seroprevalence in the model are explained below. Those calculations resulted in predictions of seroprevalence

rates for each alternative. The same definitions of minor, moderate, and major apply to changes in seroprevalence as population size.

Past data demonstrate that rates of increase and removals are highly variable from year to year and show no strong or discernible correlation. Because averages of rates of increase and removals are used, the model could predict population numbers that are higher or lower than those that might actually be observed in the future. It is important to note that results from the simple deterministic model presented in the analyses are intended to compare impacts of the alternatives based on the different management actions occurring in the alternatives.

Table 29: Total Parkwide Winter Bison Counts and Bison Management Removals Outside Yellowstone National Park, 1979-80 to 1996-97[1]

		Management Removals Outside Yellowstone National Park					
Winter	Total Winter Bison Counts	West Boundary	North Boundary	Total Removals	Percent of Population Removed	Est. Spring Population After Removals[2]	Rate of Increase
1979–80	1,727					1,727	
1980–81	1,803					1,803	1.044
1981–82	2,396					2,396	1.329
1982–83	2,239					2,239	0.934
1983–84	2,160					2,160	0.965
1984–85	2,114	0	88	88	4.2	2,026	0.979
1985–86	2,291	16	41	57	2.5	2,234	1.131
1986–87	2,433	7	0	7	0.3	2,426	1.089
1987–88	2,644	37	2	39	1.5	2,605	1.090
1988–89	3,159	2	567	569	18.0	2,590	1.213
1989–90	2,606	3	1	4	0.2	2,602	1.01
1990–91	3,178	14	0	14	0.4	3,164	1.221
1991–92	3,426	22	249	271	7.9	3,155	1.083
1992–93	3,304	79	0	79	2.4	3,225	1.047
1993–94	3,551	5	0	5	0.1	3,546	1.101
1994–95	3,956	119[3]	305	424	10.7	3,532	1.116
1995–96	3,398	393	33	426	12.5	2,972	0.962
1996–97	3,436	358	726	1,084[4]	31.5	2,352	1.156
MEAN					5.1[5]		1.082[6]

NOTE: Table 13 in the "Affected Environment" contains population sizes and removals starting in 1902.

1. From M. Meagher, unpub. data 1993; M. Meagher, pers. comm.; Montana Department of Fish, Wildlife and Parks, unpub. data;, Montana Department of Livestock, unpub. data.
2. These estimated totals assume zero losses to winterkill.
3. Does not include four illegal kills.
4. As of May 9, 1997.
5. Mean includes management removals from 1984–85 to 1995–96.
6. Geometric mean of rate of increase.

Seroprevalence Estimates

For many of the alternatives, bison removals are tied to serological status of the animal. Therefore, annual seroprevalence rates were estimated for each alternative to use in predicting the changes in seroprevalence rates and predicting impacts on the bison population. Although all alternatives include vaccination in estimates of seroprevalence, efficacy of the vaccine that would be eventually used is unknown (because the safety and effectiveness of current vaccines have not been tested in bison) and was assumed based on studies of earlier vaccines.

Seroprevalence estimates in the Yellowstone herd have varied from 28% seropositive in the park interior during 1964–68 (NPS, Meagher 1973) to 54% seropositive among bison removed through hunting and agency shooting between 1984 and 1989 (Pac and Frey 1991). Between 1985 and 1992, 49% of 904 bison sampled as a result of management actions were seropositive. Based on these estimates, initial seroprevalence was assumed to be 50% for model calculations.

The efficacy (preventing infection) of Strain 19 vaccine in cattle has been estimated at approximately 65% (Davis et al. 1991), and about 9% in bison calves (Davis et al. 1989). Twenty-five percent of bison vaccinated as calves were protected from having abortions when injected with a challenge dose of *Brucella* bacteria (Davis et al. 1989). Based on the ability of the vaccine to protect adults from infection and from having abortions, efficacy values used in the model were 70% and 25%, respectively. For the purposes of the model, efficacy was assumed to mean the percent of the vaccinated population for which there was no chance of seroconversion. For the purposes of the model, vaccination was assumed to begin in the year 2000 after safety and efficacy testing in bison was expected to be completed. For alternatives 1 through 4, the beginning population of seronegative adult bison and a proportion of vaccinated calves that were seronegative and recruited into the adult population were assumed to remain seronegative in subsequent years. Beginning in 2000 for alternatives 1 through 4, the model assumed that approximately 95% of bison calves would be vaccinated. In alternative 5, vaccination of 95% of seronegative bison calves and adults was assumed to begin in 2000, during the capture and testing operations. In alternative 6, whole herd vaccination of 95% of the bison population would be the primary method of brucellosis control and was assumed to begin in 2000. The rate at which unvaccinated and vaccinated but unprotected calves, the 30% (100%–70% effective) or 75% (100%–25% effective; see above) of calves for whom the vaccination is ineffective, became seropositive in the model was based on the seroprevalence of the adult bison population for that year.

Computer simulation of the effect of vaccines in bison calves in Grand Teton indicated vaccines would reduce the initial population seroprevalence rate of 61% to a seroprevalence rate of 23% in 20 years (Peterson, Grant, and Davis 1991). Because abortion events containing infected tissues were considered the most likely vector for exposure to other animals, factors such as vaccination that might provide protection from abortion could result in seroprevalence lower than predicted by the model.

The predicted seroprevalence rates are useful for comparison among alternatives. However, because the models are based on average migration, capture, and slaughter rates, the actual numbers might not be accurate in the short term. Realistically, bison migrations (and therefore capture, slaughter, and decreased seroprevalence rates) follow stochastic events, such as weather changes and forage production in a given year. Since the seroprevalence estimate in any alternative for a particular year might or might not be realistic, alternatives cannot be accurately tested for statistical differences.

Stochastic Influence on Bison Population

The variability of a stochastic bison population model might be high because of various environmental factors that could be included. The resulting population differences among alter-

natives generated by such a stochastic model might be less than those generated by a simple deterministic model. The population model used in this analysis is deterministic, and it is not capable of predicting changes in bison numbers that might result from events such as severe weather.

Except for alternatives 5 and 6, all management removals would occur in response to bison migrations at or near the park boundary, i.e., a stochastically influenced event. Regardless of the alternative, few bison would be removed during years when few bison migrated, and substantial numbers of bison could be removed when large numbers of bison migrated. For this reason, the actual differences in the consequences to bison numbers among alternatives might be greater or less than that predicted by the deterministic model.

To help understand the influence of stochastic events and resulting bison management, the number of bison killed (shot or sent to slaughter), sent to quarantine, hunted, or allowed to range on public lands was estimated assuming a small, medium, and large migration out of the park for each alternative. Therefore, the analysis also shows the relative disposition of bison under each of these three scenarios for each alternative (see "Stochastic Influences on Bison Population" in each alternative and tables 31, 32, and 33.).

The three different migration sizes were based on the largest number of bison removed in one winter (1,084 in 1996–97). A simple percentage of this number was taken for the low of 108 bison (10% of 1,084). An average migration of 236 bison was calculated using actual exit data for the past 13 years. The upper end migration of 975 was again a percentage (90%) of the largest removal recorded (1,084). At each level it was assumed, based on averages from the past 13 years, that 66% of the bison would exit the park along the north boundary, and 34% would exit along the west boundary. In most alternatives, serological status determines how many bison would be sent to slaughter. As described above, seroprevalence was assumed to be at the current level of approximately 50%. The number of bison killed (shot or sent to slaughter), sent to quarantine, hunted, or allowed to roam on public lands was determined for each alternative based on the management actions specified in that alternative. Management at low population levels in many alternatives would include temporarily holding some bison at the Stephens Creek capture facility for return to the park. However, for this analysis no bison were assumed to be returned to the park.

This analysis is useful for comparing the influence of stochastic events in determining the fate of bison under each alternative (or phase of alternative), but is not intended to predict the number of bison exiting the park because of the unpredictable nature of weather events and other factors that influence bison movements.

Under all alternatives except alternative 5, approximately 100–200 bison would be allowed to roam in the Eagle Creek/Bear Creek area north of Yellowstone National Park. These bison are not included in the estimates of numbers of bison exiting the park or in the estimates of disposition of exiting bison discussed in the analysis of each alternative (see "Stochastic Influence on Bison Population").

IMPACTS COMMON TO ALL ALTERNATIVES

All of the alternatives include lethal management actions to control the distribution of bison and prevent situations in which brucellosis might transmit from bison to cattle. Except for alternatives 5 and 6, all lethal actions occur in response to stochastic events.

The movement of bison to the boundary area of Yellowstone National Park is affected by many factors, including annual summer forage production, the severity of winter weather, (particularly snow depth and condition), and previous bison movement experience. There are also dramatic differences between the movements of bison on the northern winter range and

the interior areas such as Pelican Valley, Hayden Valley, and Madison-Firehole area.

The northern winter range is lower elevation grassland area that has significantly lower snow depths than other areas of the park. The road between Mammoth Hot Springs and Cooke City is plowed for wheeled vehicle use all winter. There is an elevational gradient from the upper areas of the winter range in the Lamar River valley to the lower elevations along the Yellowstone River as it exits the park near Gardiner, Montana. There are no significant areas of geothermal activity that are used by bison on the northern range.

Bison movements on the northern range are highly variable. They are not correlated with population size, but appear to be influenced by extremely severe winter weather, particularly deeper than normal snow combined with saturated and frozen snow conditions or ice layers. These conditions occurred in the winters of 1988–89, 1991–92, and 1996–97 and correspond to years of very high removals of bison when most of the northern herd moved to lower elevations and exited the park. Consequently, at current population levels, movements on the northern range appear to be highly influenced by extreme winter weather events, which sometimes result in episodic movements of most bison to lower elevations of the northern winter range.

In the park interior, snow depths are normally much greater, and there is little elevational gradient. A distinguishing feature is the large areas of geothermal activity, offering bison a thermal buffer during winter. Bison foraging in these areas, where temperatures are modified, minimize energy expenditure and experience body heat savings. Bison movements from the interior seem to be less episodic than on the northern range although they are still highly variable. Movements beyond park boundaries range from 0% to 10% of the interior populations compared to the near total migrations of northern range population during extreme weather events.

Except for short-term reductions that might be associated with extreme stochastic events, none of the alternatives, except alternative 5, would reduce the bison population below a level of 1,700, i.e., the maximum herd size that can be supported in Yellowstone National Park during periods of severe winter and limited forage production.

Agency-implemented lethal controls would decrease as the population approached 1,700 bison and would cease at 1,700 bison in certain areas described in management sections of each area. In general, bison would be hazed from areas where they are not permitted, such as outside SMAs or on private land, and shot only if hazing were unsuccessful. Bison posing a low possibility of brucellosis transmission as designated by the Montana state veterinarian and those that tested negative and were previously released would be allowed on public land. Bison posing a higher possibility of brucellosis transmission would be removed.

Based on limited available data, a minimum of 580 bison is required to maintain genetic viability and diversity in the population (Knowles, unpub. data). However, over the life of the plan, the deterministic model predicts the number of bison would increase under each alternative. Even during the most extreme stochastic events analyzed (90% of the 1996–97 migration), no alternative would result in population drops below 580. In all alternatives, lethal controls would cease at population levels considerably higher than 580. Therefore, none of the alternatives is expected to compromise the genetic viability or diversity of bison in Yellowstone National Park.

Management actions in all alternatives except alternative 5 would not measurably affect the age/sex distribution or reproductive rates of bison. In alternative 5, either or both could be affected.

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

The bison population is affected by a number of natural factors, including severe weather, forage production, and predation, as well as human actions not part of this management plan. Wolf and grizzly predation might reduce the population, although studies predict wolf predation at its maximum would result in no more than a 15% decrease in bison numbers (Boyce and Gaillard 1992). Grizzly bears eat bison meat, but it is usually in the form of carrion, rather than prey the bears have killed. Cumulative effects from grizzly bears on the bison population to date are negligible or minor. Vehicle collisions might also contribute to negligible additional mortality. A small number of bison also move from Yellowstone into the North Fork Shoshone River drainage where a few could be removed through hunting in Wyoming. Periodic severe winter weather can also cause varying (sometimes significant) levels of natural winterkill. Typically, young (calves and yearlings) and older animals die first. During the severe winter of 1996–97, approximately 300–400 bison (8%–11% of the early winter population) were estimated to have died due to natural mortality.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Effects on the Bison Population. Alternative 1 has no specific population management objectives identified, and therefore, ecological factors and bison management actions were assumed to maintain the population between the ecologically defined range of 1,700 to 3,500 animals. This alternative emphasizes capture of bison at Stephens Creek and shipment of all these animals to slaughter (see 1996 *Interim Bison Management Plan*). Seropositive bison and seronegative-pregnant females captured at West Yellowstone are sent to slaughter. Seronegative males and seronegative-nonpregnant females are released on public lands in the Horse Butte area.

Given the assumptions described in the "Methodologies for Analyzing Impacts," the model predicts selecting alternative 1 would result in an increasing bison population. From 1997 to 2006, the bison population is projected to increase from about 2,100 bison to approximately 3,100 (overall average increase 4% per year following capture and slaughter operations; see table 30). By 2011 the population is estimated to reach 3,500. Capture and shipment of bison to slaughter and periodic severe environmental conditions would likely maintain the bison population within the range of 1,700 to 3,500. Episodic movements of bison caused by severe winters could result in larger than estimated removals and reduce population growth and overall population size. Similarly, a series of mild winters could result in increased population sizes. If assumptions described above under "Methodologies for Analyzing Impacts" for the population model are correct, implementation of this alternative would result in an increase in the bison population of about 63% over the life of the management plan. The population growth rates of all other alternatives are contrasted to this "no action" rate for comparison purposes.

Effects on Free-Ranging Status and Distribution of Bison. Management activities such as capture, slaughter, and shooting would keep bison from moving beyond the identified management areas. On private lands where the landowner wanted bison removed, agency personnel would shoot those bison. For the life of the plan, there would be no bison north of the park boundary at Reese Creek. Bison would freely range in Yellowstone National Park except near the Stephens Creek capture facility. Winter management objectives would allow up to 50–100 seronegative bison in the West Yellowstone region, but modeling indicates only 18 to 52 seronegative-nonpregnant (i.e., those that were tested and released) bison would remain after testing in this area. This alternative would provide for 100–200 bison to freely range on public lands in the Eagle Creek/Bear Creek SMA.

Table 30: Estimated Early Winter Population, Rate of Population Increase, Projected Management Removals, and Estimated Seroprevalence Rate for the Bison Population under Alternative 1

			Management Removals Outside Yellowstone National Park				
Year	Early Winter Population	Yearly Percent Increase	North Boundary	West Boundary	Total Removals	Remaining on Public Land Outside YNP at West	Estimated Percent Sero-prevalence[1]
1997	2,156		--	62	62	48	50
1998	2,266	5.1	--	64	64	52	49
1999	2,383	5.2	80	23	103	18	48
2000	2,467	3.5	83	22	105	21	47
2001	2,556	3.6	86	22	108	22	45
2002	2,649	3.6	89	22	111	24	42
2003	2,746	3.7	92	22	114	26	39
2004	2,848	3.7	96	21	117	28	37
2005	2,955	3.8	99	22	121	29	35
2006	3,066	3.8	103	22	125	31	33
2011	3,500						24
MEAN[2]		4.0					

1. Based on calfhood vaccination beginning in 1999 and 70% vaccine efficacy.
2. Mean rate of increase calculated from 1997 to 2006.

Under this alternative, bison movements would probably remain similar to what they have been in recent years. To date, bison continue to winter in the interior of the park (Pelican and Hayden Valleys) and provide a spring source of carrion to grizzly bears in this area (Meagher, pers. comm.).

Seroprevalence in the Bison Population. The population seroprevalence rate is expected to decline from a starting point of 50% seropositive in 1997 to at least 33% seropositive in 2006 due to removal of seropositive bison leaving Yellowstone National Park in West Yellowstone and Reese Creek, and calfhood vaccination at 70% efficacy beginning in 2000 (see table 30). Continued management efforts and calfhood vaccination would reduce seroprevalence to 24% in 2011. Assuming calfhood vaccination and a vaccine efficacy of 25%, seroprevalence was predicted to drop from 50% to 40% by 2006.

Stochastic Influence on Bison Population. All bison exiting at the north boundary would be captured and shipped to slaughter, along with all seropositive bison and all seronegative-pregnant females captured exiting at the west boundary. Based on current seroprevalence and pregnancy rates and the average proportion of bison exiting at the north boundary versus the west boundary, 85% of bison exiting Yellowstone National Park under this alternative would be sent to slaughter. Therefore, if 108 bison exited the park (10% of the highest number removed), roughly 92 would be sent to slaughter, and about 16 seronegative-nonpregnant bison would be allowed to roam on public land in the West Yellowstone area (see table 31). If 236 bison exited the park (mean number removed), roughly 201 would be sent to slaughter and about 35 seronegative-nonpregnant bison would be allowed to roam on public land near West Yellowstone (see table 32). If 975 exited the park (90% of the highest number removed), 829 would be sent to slaughter and 146 seronegative-nonpregnant bison would be allowed to roam on public land in the West Yellowstone area (see table 33).

Table 31: Number of Bison Slaughtered, Hunted, Quarantined, and Ranging in Special Management Areas if 108 Bison Were to Leave the Park (Represents 10% of the Highest Number of Bison to Historically Leave the Park - 1,084)

Alternative	Slaughtered	Hunted	Quarantine	Additional Removals[a]	Total Removed	Number Ranging in SMAs
1	92	0	0	0	92	16
2[b]	0	0	0	0	0	108
3[b]	0	60–70	0	0	60–70	38–48
4[b]	55–91	16	37–1	0	108	0
5	108	0	0	0	108	0
6	90	0	0	0	90	18
7[b]	19	20	3	0	42	66

a. According to the alternative, additional removals could include bison shipped to slaughter, quarantined, hunted, or shot by agency personnel.

b. Assumes all elements of the alternative are in place (phase 2).

Table 32: Number of Bison Slaughtered, Hunted, Quarantined, and Ranging in Special Management Areas if the Mean Number of Bison (236 Bison) Were to Leave the Park

Alternative	Slaughtered	Hunted	Quarantine	Additional Removals[a]	Total Removed	Number Ranging in SMAs
1	201	0	0	0	201	35
2[b]	0	0	0	0	0	236
3[b]	0	60–70	0	21–26	81–96	140–155
4[b]	120–199	20	81–2	0	221	15
5	236	0	0	0	236	0
6	196	0	0	0	196	40
7[b]	41	20	6	36	67–103	133

a. According to the alternative, additional removals could include bison shipped to slaughter, quarantined, hunted, or shot by agency personnel.

b. Assumes all elements of the alternative are in place (phase 2).

Table 33: Number of Bison Slaughtered, Hunted, Quarantined, and Ranging in Special Management Areas if 975 Bison Were to Leave the Park (Represents 90% of the Highest Number of Bison to Historically Leave the Park - 1,084)

Alternative	Slaughtered	Hunted	Quarantine	Additional Removals[a]	Total Removed	Number Ranging in SMAs
1	829	0	0	0	829	146
2[b,c]	0	0	0	0	0	975
3[b]	0	60–70	0	705–715	765–785	200
4[b]	498–823	20	331–6	26	875	100
5	975	0	0	0	975	0
6	810	0	0	65	875	100
7[b]	166	20	23	566	775	200

a. According to the alternative, additional removals could include bison shipped to slaughter, quarantined, hunted, or shot by agency personnel.

b. Assumes all elements of the alternative are in place (phase 2).

c. If 975 bison were to exit the park, the possibility exists that some bison might move onto private land or attempt to move beyond SMA boundaries and be shot, if hazing were unsuccessful. Predicting the total number of bison that might move beyond the boundaries of the SMAs and be shot is not possible, but it might likely be greater than zero.

Cumulative Impacts

There would be no additional sources of cumulative impact beyond those described in "Cumulative Impacts Common to All Alternatives."

Conclusion

Capture and shipment of bison to slaughter, periodic severe environmental conditions, and additional mortality would likely maintain the bison population in the range of 1,700 to 3,500, with the bison population near the higher end of the range during the later years of the management plan.

This alternative would allow bison to freely range throughout Yellowstone National Park and would provide for 100–200 bison to freely range in the Eagle Creek/Bear Creek area. Bison would not be allowed to freely range north of the Reese Creek area, and a limited number of bison would be allowed to winter in the West Yellowstone area from November 1 to May 1.

Removal of seropositive bison at Reese Creek and West Yellowstone and calfhood vaccination at 70% efficacy would be expected to decrease seroprevalence in the bison population to at least 33% by 2006 and 24% by 2011. Other factors, such as protection from abortion as a result of vaccination, might contribute to an additional decrease in seroprevalence in the bison population.

IMPACTS OF ALTERNATIVE 2

Analysis

Effects on the Bison Population. Assumptions used in alternative 1 were also used in this alternative to construct bison population dynamics. For alternative 2, the agencies would attempt to manage the Yellowstone bison population within the range of 1,700 to 3,500 animals. This alternative has two phases. In phase 1, the management actions described in alternative 1 (the interim plan) would continue. For the analysis of impacts on the bison population, phase 1 actions were assumed to occur for five years. During this time, development and implementation of phase 2 elements of alternative 2, such as changes in winter road grooming, purchase or easement of lands from willing sellers, site-specific and localized fencing, or conversion of high risk breeding cattle operations to nonbreeding cattle would occur. For purposes of analysis, these management changes were expected to be in place by 2002. At this time, alternative 2 would switch to emphasize nonlethal methods of bison control, such as hazing, to control bison distribution and reduce conflicts with other land uses. Killing of bison would be allowed to protect human safety, but such occurrences would likely be limited. Bison could be shot on private property, but other measures such as hazing or fencing would be emphasized to reduce conflicts and the need for lethal control. For purposes of this analysis, it was assumed that a lower percentage of bison would access boundary areas than in other alternatives because the groomed roads they used to leave the interior of the park would either not be maintained or would be closed.

Given the assumptions of the model, this alternative would result in growth of the bison population (4.3%) similar to alternative 1 to the year 2002 (five years). After that time the bison population was predicted to grow at about 8.2%/year due to the emphasis on nonlethal methods to control bison. The bison population would be expected to increase from about 2,100 bison to 3,500 by 2006 and remain near that level through the duration of the management plan (average increase 5.7% per year; see table 34). This would be about 14% higher than alternative 1 after 10 years of management. Lethal management removals were expected to be minimal after 2002, and as population numbers increased, conflicts with private property could increase. At higher population numbers, it was expected agencies would use lethal control, such as shooting rather than hazing, to remove bison from private lands and resolve management conflicts. Periodic severe environmental conditions, closure of some road

segments to winter use, and increased use of lethal control, particularly for some bison that moved beyond the identified management areas, would likely maintain the population near 3,500 animals.

Effects on Free-Ranging Status and Distribution of Bison. This alternative would provide the maximum potential for bison to freely range beyond Yellowstone National Park boundaries onto other public lands and private lands where they were tolerated. Few bison would be expected to move beyond the defined management area boundaries, but if they did, they would be removed.

Although management objectives would allow approximately 200 bison to winter in the Reese Creek area, estimates of between 0 and 120 bison would be expected for the first 10 years. Between 20 and 60 bison would be expected to winter in the West Yellowstone area, an area where management objectives would allow up to 50–100 bison (see table 34). Closure of some park roads during winter might reduce movement into the West Yellowstone area.

This alternative would provide for 100–200 bison to freely range on public lands in the Eagle Creek/Bear Creek area. On private lands where the landowner wanted bison removed, agency personnel could haze or shoot those bison. When the bison population was near the high end of the range (2,700 to 3,500), agency personnel would likely shoot those bison on private lands where their presence was not tolerated. At these population levels, the agencies would also be more likely to shoot rather than haze any bison moving beyond the management boundaries defined for this alternative.

Table 34: Estimated Early Winter Population, Rate of Population Increase, and Estimated Seroprevalence Rate for the Bison Population under Alternative 2

			Management Removals Outside Yellowstone National Park				
Year	Early Winter Population	Yearly Percent Increase	North Boundary	West Boundary	Total Removals*	Remaining on Public Land Outside YNP at West	Estimated Percent Sero-prevalence[1]
1997	2,156			62	62	48	50
1998	2,266	5.1		64	64	52	49
1999	2,383	5.1	80	23	103	18	48
2000	2,467	3.5	83	22	105	21	47
2001	2,556	3.6	86	22	108	22	45
2002	2,649	3.6				46	42
2003	2,866	8.2				50	40
2004	3,101	8.2				54	38
2005	3,355	8.2				58	36
2006	3,500					61	34
2011	3,500						26
MEAN[2]		5.7					

1. Based on calfhood vaccination beginning in 2000 and 70% vaccine efficacy.
2. Mean rate of increase calculated from 1997 to 2005 because the maximum modeled value of 3,500 bison was met in 2006.
* Management removals are expected to occur during phase 1 of this alternative for approximately 5 years and be the same as contemplated under alternative 1. Consistent with the management objectives of this alternative, no management removals are contemplated for this alternative after 2001. However, management removals, primarily by shooting, might occur on private land and outside SMAs beginning in 2002, but were assumed to be zero for this analysis.

In phase 1 of this alternative, no bison would be allowed north of Reese Creek, seronegative-nonpregnant females and seronegative males would be allowed in the West Yellowstone area, and untested bison would be allowed to range in the Eagle Creek/Bear Creek area. In phase 2, bison distribution would be affected by the implementation of a different set of management actions, in which winter grooming of park roads for snowmobiles would cease from the west side of the park. Bison numbers in the park were relatively low until recent times, after which snowmobile grooming had already been initiated in the park (the early 1970s). Therefore, determining what bison, at current and higher population levels, would do if there were no grooming is difficult. Without grooming, bison would not be able to move as efficiently. Whether or not they would chose to move on alternate routes is uncertain. Bison might learn to start moving to winter range earlier in the year (Aune, pers. comm.). It would be likely that more bison would die within the borders of the park if grooming and snowmobile use ceased within the park interior.

Seroprevalence in the Bison Population. The population seroprevalence rate would be expected to decline from a starting point of 50% seropositive in 1997 to at least 34% seropositive in 2006 due to calfhood vaccination at 70% efficacy beginning in 2000 (see table 34). Continued management efforts and calfhood vaccination at 70% efficacy would reduce seroprevalence to 26% in 2011. With calfhood vaccination and a vaccine efficacy of 25%, seroprevalence was predicted to drop from 50% to 42% by 2006.

Stochastic Influence on Bison Population. During approximately the first five years of alternative 2, it was assumed not all components of the alternative would be in place. Therefore, during that time period the disposition of bison would be expected to be the same as under alternative 1, with 85% of bison exiting the park removed through shipment to slaughter.

Once all components of the alternative were in place, all bison that exited the park would be allowed to winter on adjacent public land in the western and Reese Creek SMAs. Although hazing would be the preferred method used to move bison off private land in this alternative, a small number of bison that cannot be hazed could be shot. Some number of bison might be shot at the SMA boundaries if they could not be successfully hazed. That number is not possible to predict, but would likely be negligible except possibly in severe winters at high population levels. If 108 bison exited the park (10% of the highest number previously removed), approximately 72 bison might winter in the north boundary area and 36 bison might winter in the west boundary area (see table 31). If 236 bison exited the park (mean number of removals), approximately 156 bison might winter in the north boundary area and approximately 80 bison might winter in the west boundary area (see table 32). If 975 bison exited the park (90% of the highest number previously removed), approximately 644 bison might winter in the north boundary area, and approximately 331 bison might winter in the west boundary area (see table 33). At these levels, it is possible that bison would move onto private land or attempt to move beyond SMA boundaries and be shot if hazing was unsuccessful. The number of bison likely to be shot cannot be predicted but could be substantially more than that estimated when fewer bison exited the park.

Cumulative Impacts

No additional sources of cumulative impact would exist beyond those described in "Cumulative Impacts Common to All Alternatives."

Conclusion

Periodic severe environmental conditions, closure of some road segments within the park to winter use, and increased use of lethal control, particularly for some bison that moved beyond the identified management areas, would allow the population to fluctuate up to 3,500 animals. It is estimated this alternative would result in

moderately more bison in the population (14%) than alternative 1.

This alternative would provide the maximum potential for bison to freely range beyond Yellowstone National Park boundaries onto other public lands and private lands where they would be tolerated. Between 100 and 200 bison could freely range in the Eagle Creek/Bear Creek area. Between 0 and 120 bison could winter in the Reese Creek area, and 20–60 could winter in the West Yellowstone area.

Calfhood vaccination at 70% efficacy of this population was predicted to decrease seroprevalence to at least 34% in 2006 and 26% by 2011. This alternative would be expected to result in a minor increase in seroprevalence rate (3%–8% higher) compared to alternative 1.

IMPACTS OF ALTERNATIVE 3

Analysis

Effects on the Bison Population. Assumptions used in alternative 1 were also used in this alternative to construct bison population dynamics. For alternative 3, the agencies would attempt to manage the Yellowstone bison population within the range of 1,700 to 3,500 animals. This alternative emphasizes recreational hunting as the primary method to control bison numbers and distribution on adjacent public and private lands in Montana. If bison moved to the Reese Creek area prior to approved hunting or large numbers were present that make hunting infeasible, the capture facility at Stephens Creek (or a possible facility north of the Reese Creek area) could be used as a backup measure to control bison numbers. Captured seronegative bison would be sent to quarantine. If population numbers were low (near 1,700), bison might be held temporarily at capture facilities and released in the spring when forage was available. No capture operations would occur in the West Yellowstone area, and bison numbers would be primarily controlled through hunting.

The model assumed hunting would begin in 2000 and initial quotas would provide for a minimum of 15 permits in the Eagle Creek/Bear Creek area. Bulls would likely be harvested in this area. Assuming land acquisition (see description of alternative 3 in "The Alternatives"), 30 permits would be offered in the Reese Creek area. Bulls and larger females would likely be harvested in this area. Due to increasing bison numbers moving into the Reese Creek area, the model assumed 35 permits would be offered beginning 2005. Thirty permits would be initially offered in the West Yellowstone area; 35 would be offered beginning 2005. Nearly all bison, except possibly calves, would be harvested in this area. Based on bison population numbers, winter distribution on public and private lands, and other factors, the agencies might conduct additional special drawings to harvest additional bison.

Given the assumptions described in the "Methodologies for Analyzing Impacts," the model predicts moderately higher growth rates for alternative 3 than the no-action scenario (alternative 1). For the life of the management plan, bison distribution and population numbers would be controlled through hunting. From 1997 to 2006, the bison population would be expected to increase from about 2,200 bison to 3,500 (average increase 6%/year; see table 35), where it would remain (on average) until 2011. This would be about 14% higher following 10 years of implementation than alternative 1. Limited capture operations, agency shooting, hunting, and periodic severe environmental conditions would likely maintain the bison population above the population midpoint of 2,500–2,700 but within the long term range of 1,700–3,500.

Effects on Free-Ranging Status and Distribution of Bison. Under this alternative, bison movements would probably remain similar to what they have been in recent years. Few bison would be expected to move beyond the identified management area, but if they did, they would be removed. Agency personnel would shoot bison on private lands where the landowner wanted them removed and hunting was not allowed. Management objectives would

allow 100–200 bison to winter in the Eagle Creek/Bear Creek area, and approximately 100 bison would be expected to winter in this area.

During phase 2, winter management would allow up to 50–100 bison in the Reese Creek area when additional lands were acquired. Following hunter harvests, approximately 60–80 bison would winter in the area for the 15 years the plan was in effect. The population would likely consist of younger males and females and calves. More bison could be allowed in this area if additional winter range was purchased or easements were acquired from willing sellers on private lands.

In the West Yellowstone area, management objectives would allow up to 50–100 bison to winter in the West Yellowstone area. However, nearly all bison would be removed, with 16–30 (and 44–130 remaining before the hunt begin in 2000) bison remaining after the hunt (see table 35). Those remaining would likely be subadult males, females, or calves. More bison could be allowed in this area if winter range was purchased or easements were acquired on private lands and hunting quotas were modified.

Seroprevalence in the Bison Population. The population seroprevalence rate would be expected to decline from a starting point of 50% seropositive in 1997 to at least 36% seropositive in 2006 due to the removal from capture and slaughter (as a backup to hunting) of seropositive bison leaving Yellowstone National Park and calfhood vaccination at 70% efficacy beginning in 2000 (see table 35). Continued management efforts and calfhood vaccination at 70% efficacy would reduce seroprevalence to 28% by 2011. With calfhood vaccination and a vaccine efficacy of 25%, seroprevalence was predicted to drop from 50% to 45% by 2006. Reduced seroprevalence would be similar to alternative 2 because hunters would presumably remove both seronegative and seropositive bison in proportion to the population seroprevalence.

Stochastic Influence on Bison Population. During phase 1 of this alternative, it was assumed that quarantine facilities would not be in operation and hunting would not be implemented. Therefore, during this period all bison exiting the north boundary of the park would be shipped to slaughter. All bison exiting the west boundary would be free to roam on public lands in winter. For this alternative approximately 66% of bison exiting the park would be removed from the population through shipment to slaughter during the first two years. If 108 bison exited the park (10% of the highest number removed), roughly 72 would be sent to slaughter and about 36 would be allowed to winter on public land in the West Yellowstone area (see table 31). If 236 bison exited the park (mean number removed), roughly 156 would be sent to slaughter and about 80 would be allowed to winter on public land near West Yellowstone (see table 32). If 975 exited (90% of the highest number removed), 644 would be sent to slaughter and approximately 331 might winter in the west boundary area (see table 33). This alternative would allow up to 50–100 bison in this area, and the agencies might remove 250 more bison from the population in the West Yellowstone area.

During phase 2 of this alternative, hunting would be the primary management tool used in both the north and west boundary areas, and the capture facilities at Stephens Creek would be removed and relocated north into the Reese Creek SMA. Beginning in the year 2000, hunting in the north boundary area and in the West Yellowstone area would remove a total of 60–70 bison (30–35 in each area). If 108 bison exited the park (10% of the highest number removed), roughly 72 would exit north and about 36 would exit west. Between 30 and 35 bison could be hunted in each area (56%–65% of bison exiting), leaving 37–42 bison to winter on public lands in the Reese Creek area and approximately 1–6 bison wintering on public lands near West Yellowstone. If 236 bison exited the park (mean number of removals), approximately 156 would exit north and 80 would exit west. Following the hunting removals of 30–35 bison in each area, 121–126 bison would winter on public lands in the north boundary area, and 45–50 would winter on public lands in the West Yellowstone area.

TABLE 35: ESTIMATED EARLY WINTER POPULATION, RATE OF POPULATION INCREASE, PROJECTED MANAGEMENT REMOVALS DUE TO HUNTING, AND ESTIMATED SEROPREVALENCE RATE FOR THE BISON POPULATION UNDER ALTERNATIVE 3

			Management Removals Outside Yellowstone National Park[1]				
Year	Early Winter Population	Yearly Percent Increase	North Boundary	West Boundary	Total Removals	Remaining on Public Land Outside YNP at West	Estimated Percent Sero-prevalence[2]
1997	2,156		0	0	0	110	50
1998	2,333	8.2	0	0	0	119	50
1999	2,524	8.2	85[3]	0	85	44	50
2000	2,639	4.6	45	30	75	16	50
2001	2,775	5.2	45	30	75	18	47
2002	2,921	5.3	45	30	75	21	45
2003	3,079	5.4	45	30	75	23	43
2004	3,250	5.6	45	30	75	26	40
2005	3,435	5.7	50	35	85	25	38
2006	3,500		50	35	85	26	36
2011	3,500						28
MEAN[4]		6.0					

1. Beginning in the year 2000, hunting on the north boundary would remove 30 bison in the Reese Creek area (35 beginning 2005), 15 bison at Eagle Creek/Bear Creek, and 30 bison in the West Yellowstone area (35 beginning 2005).
2. Based on calfhood vaccination beginning in 2000 and 70% vaccine efficacy.
3. This total included bison captured at the Reese Creek area because hunting does not begin until 2000.
4. Mean rate of increase calculated from 1997 to 2005 because the maximum modeled value of 3,500 bison was met in 2006.

Management objectives would allow up to 50–100 bison to winter for the Reese Creek area; thus, an additional 21–26 bison might be hunted, shipped to slaughter, or quarantined. Approximately 81–96 bison (34%–41% of bison exiting the park) could be removed from the population. If 975 bison exited the park (90% of the highest number removed), approximately 644 would exit north and 331 would exit west. Following hunter removals of 30–35 bison in each area, 609–614 bison would be located in the Reese Creek area and 296–301 bison would be located in the West Yellowstone area. Management objectives would allow up to 50–100 bison to winter on public lands in each of these areas; therefore, an additional 509–514 bison in the Reese Creek area and 196–201 bison in the West Yellowstone area might be hunted, shipped to slaughter, or quarantined. Approximately 765–785 bison (78%–81% of bison exiting the park) could be removed from the population.

Cumulative Impacts

No additional sources of cumulative impact would exist beyond those described in "Cumulative Impacts Common to All Alternatives."

Conclusion

This alternative would maintain the bison population within the range of 1,700 to 3,500 and would be expected to result in growth of the population. Limited capture operations, agency shooting, hunting, and periodic severe environmental conditions would allow the

population to fluctuate up to 3,500 animals. This alternative could result in moderately more bison in the population (14%) compared to alternative 1.

This alternative would allow bison to freely range throughout Yellowstone National Park, and approximately 100 bison would be expected to freely range in the Eagle Creek/Bear Creek area. Following hunter harvests, approximately 60–80 bison would winter in the Reese Creek area for the life of the management plan. Fewer bison might winter in this area if the capture facility was used to control bison numbers in this area. More bison might be allowed in this area if additional winter range was purchased or easements were acquired on private lands from willing sellers. After hunter harvests, fewer than 30 bison would winter in the West Yellowstone area.

Calfhood vaccination at 70% efficacy were predicted to decrease seroprevalence to at least 36% in 2006 and 28% by 2011. The model predicts a minor to moderate increase in seroprevalence rate (9%–17% higher) compared to alternative 1.

IMPACTS OF ALTERNATIVE 4

Analysis

Effects on the Bison Population. Assumptions used in alternative 1 were also used in this alternative to construct bison population dynamics. For alternative 4, the agencies would attempt to manage the Yellowstone bison population within the range of 1,700 to 3,500 animals. This alternative emphasizes capture of bison at Stephens Creek and shipment of seronegative bison to quarantine. As the population approached 3,500, the agencies might be more likely to use lethal control (capture and shipment to slaughter, agency shooting, or hunting) or quarantine to manage bison numbers, distribution, and conflicts with other land uses. As the population approached 1,700, the agencies might emphasize nonlethal means (such as hazing or fencing) to manage bison numbers, distribution, and conflicts. Bison could be temporarily held at capture facilities through the winter if population numbers were low (near 1,700) and the winter severe. Hunting would be used to control populations in the Eagle Creek/Bear Creek area. Capture operations would occur at West Yellowstone, and only seronegative males and seronegative-nonpregnant females would be allowed on public lands in the West Yellowstone area. Low levels of hunting would be allowed in the West Yellowstone area as an adjunct to capture operations.

Hunting would begin in 2000, and quotas would provide for a minimum of 15 permits in the Eagle Creek/Bear Creek area and 20 in the West Yellowstone area. Based on bison population numbers, winter distribution on public and private lands, and other factors, the agencies could conduct additional special drawings to harvest additional bison.

Under this alternative, bison population numbers would be controlled through capture, shipment of seropositive bison to slaughter, and hunting. Modeling indicates the population would increase at a slower rate than alternatives 1, 2, 3, or 6. From 1997 to 2006, the bison population was expected to increase from about 2,100 bison to 2,800 (average increase 3%/year; see table 36). This would be about 8% fewer bison after 10 years of management than if alternative 1 was implemented. By 2011 the model predicted the population could reach nearly 3,200. However, in combination with periodic severe environmental conditions, it would be likely that capture operations and limited hunting would maintain the long-term bison population between 2,800 and 3,200 after 10 years.

Effects on Free-Ranging Status and Distribution of Bison. Under this alternative, bison movements would probably remain similar to what they have been in recent years. Bison would not be expected to move beyond the identified special management area, but if they do, they would be removed. On private lands where the landowner wants bison removed and hunting was not allowed, agency personnel would shoot those bison.

Winter range management objectives would allow 100–200 bison to freely range in the Eagle Creek/Bear Creek area. Beginning in the year 2000, an annual hunter harvest of 15 animals would be expected in the Eagle Creek/Bear Creek area. Bulls would likely be harvested in this area.

Bison would be allowed to freely range in Yellowstone National Park except near Stephens Creek where the capture facility was located. No bison would be allowed in the Reese Creek area. Management objectives would allow up to 50–100 seronegative male and seronegative-nonpregnant female bison in the West Yellowstone area, and 18–52 animals would be expected following the removal of animals testing seropositive (and seronegative-pregnant female bison). Beginning in 2000, annual hunter harvests of 20 bison would likely consist of males, but some larger females might also be taken. Following hunter harvests, few if any bison would winter in the West Yellowstone area for the life of the management plan (see table 36).

Seroprevalence in the Bison Population. The population seroprevalence rate would be expected to decline from a starting point of 50% seropositive in 1997 to at least 34% seropositive in 2006 due to removal of seropositive bison in the West Yellowstone and Reese Creek area and calfhood vaccination at 70% efficacy beginning in 2000 (see table 36). Continued management efforts and calfhood vaccination at 70% efficacy would reduce seroprevalence to 26% in 2011. With calfhood vaccination and a vaccine efficacy of 25%, seroprevalence was predicted to drop from 50% to 42% by 2006.

Stochastic Influence on Bison Population. During the first phase of implementation, alternative 4 would be similar to alternative 1. Therefore, the same number of bison would be removed from the population as in alternative 1 (85% of those exiting the park). During this phase, if 108 bison exited the park (10% of the highest number removed), approximately 92 bison would be sent to slaughter, and 16 seronegative-nonpregnant bison would be allowed to winter on public lands in the West Yellowstone area (see table 31). If 236 bison exited the park (mean number of removals), approximately 201 bison would be sent to slaughter, and 35 seronegative-nonpregnant bison would be allowed to winter on public lands in the West Yellowstone area (see table 32). If 975 bison exited the park (90% of the highest number removed), approximately 829 bison would be sent to slaughter, and 146 seronegative-nonpregnant bison would winter on public lands in the West Yellowstone area (see table 33). Management objectives would allow up to 50–100 bison to winter in the West Yellowstone area; therefore, the agencies could remove an additional 46 bison from the population. For this scenario approximately 875 bison (90% of total exiting the park) could be removed from the population.

Phase 2 of alternative 4 would begin in the year 2000, with the addition of hunting and quarantine as management tools to control bison numbers. Alternative 4 would provide the agencies with an option to vary the number of bison sent to slaughter or quarantine. For each of the exiting levels discussed above, the number of bison removed from the population would increase by 20 (the number of hunting permits allowed in the West Yellowstone area). Therefore, if 108 bison exited the park (10% of the highest number removed), all 108 bison (100% of those exiting) would be removed from the population. Disposition of those bison would range from 55 sent to slaughter and 37 sent to quarantine, to 91 sent to slaughter and 1 sent to quarantine; the remaining 16 would be removed through hunting. If 236 bison exited (mean number of removals), a total of 221 (94% of those exiting) would be removed from the population. Disposition of those bison would range from 120 sent to slaughter and 81 sent to quarantine to 199 sent to slaughter and 2 sent to quarantine; hunting would remove another 20 bison. The remaining 15 seronegative-nonpregnant bison could be allowed to winter on public lands in the West Yellowstone area or sent to quarantine. If 975 bison exited the park (90% of the highest number removed), 849 would be removed from the population.

TABLE 36: ESTIMATED EARLY WINTER POPULATION, RATE OF POPULATION INCREASE, PROJECTED MANAGEMENT REMOVALS, AND ESTIMATED SEROPREVALENCE RATE FOR THE BISON POPULATION UNDER ALTERNATIVE 4

			Management Removals Outside Yellowstone National Park				
Year	Early Winter Population	Yearly Percent Increase	North Boundary[1]	West Boundary[2]	Total Removals	Remaining on Public Land Outside YNP at West	Estimated Percent Sero-prevalence[3]
1997	2,156		--	62	62	48	50
1998	2,266	5.1	--	64	64	52	49
1999	2,383	5.2	80	23	103	18	48
2000	2,467	3.5	98	42	140	1	47
2001	2,518	2.1	100	42	142	2	45
2002	2,571	2.1	102	42	145	3	43
2003	2,626	2.1	103	42	145	4	41
2004	2,684	2.2	105	41	146	6	38
2005	2,746	2.3	107	40	147	8	36
2006	2,812	2.4	110	40	150	9	34
2011	3,188						26
MEAN[4]		3.0					

1. Totals include seropositive and seronegative bison captured at Stephens Creek facility and sent to slaughter, and 15 bison hunted at Eagle Creek/Bear Creek beginning in 2000.
2. Totals include seropositive and seronegative-pregnant bison captured in the West Yellowstone area and sent to slaughter and 20 bison hunted in the West Yellowstone area beginning in 2000.
3. Based on calfhood vaccination beginning 2000 and 70% vaccine efficacy.
4. Mean rate of increase calculated from 1997 to 2006.

Disposition of those bison would range from 498 sent to slaughter and 331 sent to quarantine to 823 sent to slaughter and 6 sent to quarantine; hunting would remove another 20 bison. The remaining 126 seronegative-nonpregnant bison could winter on public lands in the West Yellowstone area or be sent to slaughter. Management objectives would allow for up to 50–100 bison to winter in the West Yellowstone area, and an additional 26 bison could be removed from the population through hunting, quarantine, or agency shooting. For this scenario a total of 875 bison (90% of those exiting the park) could be removed from the population.

Cumulative Impacts

There would be no additional sources of cumulative impact beyond those described in "Cumulative Impacts Common to All Alternatives."

Conclusion

This alternative would maintain the bison population within the range of 1,700 to 3,500 animals and would be expected to result in an increasing bison population. Capture operations, limited hunting, and periodic severe environmental conditions would likely maintain the population between 2,800 and 3,200 bison in the long term. It was estimated this alternative would result in fewer but minor differences in numbers of bison in the population (8.2% fewer) after 10 years of implementation compared to alternative 1.

This alternative would allow bison to freely range within Yellowstone National Park except

in the Stephens Creek area. Approximately 100–200 could freely range in the Eagle Creek/Bear Creek area, and no bison would be allowed to range in the Reese Creek area. Although seronegative-nonpregnant bison would be released in West Yellowstone, few would be expected to remain after hunting.

Capture and removal of seropositive bison and calfhood vaccination at 70% efficacy were predicted to decrease seroprevalence to at least 34% in 2006 and 26% by 2011. This alternative would be expected to result in a minor reduction (less than 10% change) in seroprevalence compared to alternative 1.

IMPACTS OF ALTERNATIVE 5

Analysis

Effects on the Bison Population. In calculating the impacts on the bison population, it was assumed that capture, test, and slaughter operations would take place in nine areas simultaneously within and at the boundary of Yellowstone National Park. Simultaneous captures would be necessary to reduce the likelihood that untested, potentially infected bison would come into contact with seronegative bison that had been tested and released in the park. Based on methods used in the livestock industry, it was assumed that capture, test, and slaughter operations would begin in 1998 and be conducted for three consecutive years (Peterson, Grant, and Davis 1991). All seropositive bison would be sent to slaughter. Unlike alternatives 1 through 4, in which only calves were vaccinated, this alternative calls for all seronegative bison to be vaccinated before release. During a fourth and possibly fifth year, all unmarked (untested) bison more than one year old would be shot.

It was assumed that 95% of the bison population would be captured each year (Peterson, Grant, and Davis 1991), with the remaining 5% exhibiting a seroprevalence rate similar to that found in the total precapture population for that year. The seroconversion rate for adult bison used in the Yellowstone National Park model was assumed to be zero because approximately 95% of seropositive bison would be removed in the first year of capture operations beginning in 1998. Dobson and Meagher (1996) found that brucellosis transmission rate in Yellowstone National Park bison appeared to be a function of the proportion of individuals in the bison population that are infected. Also, all captured seronegative bison would be vaccinated. In addition to protecting against infection, vaccination prevents abortion and hence transmission of the bacteria. The seroprevalence rate for unvaccinated and vaccinated but unprotected calves was assumed to be equal to the seroprevalence in the adult population for that year.

For alternative 5, the agencies would attempt to manage the Yellowstone bison population within the range of 1,700 to 3,500 animals; however, this alternative is impossible to implement without reducing the population below 1,700 for at least six years following its start. The bison population would be expected to be reduced to approximately 1,250 animals in 1999, after removal of over 1,000 bison in the first year of capture, test, and slaughter. This compared to nearly 2,400 animals in 1999 under the continued implementation of alternative 1 (a 47% decrease compared to alternative 1). The bison population would be expected to number approximately 2,000 by 2006, and approximately 2,900 bison by 2011, 10 years after capture, test, and slaughter operations have ceased. This was comparable to model simulations (Peterson, Grant, and Davis 1991) that showed the Grand Teton National Park bison population recovered to preremoval size within about 10 years following test, slaughter, and vaccination operations. It is possible under alternative 5, in which bison numbers were projected to be reduced as low as 1,250, certain segments of the park bison population would be more affected than others.

Slowing the rate at which bison were slaughtered might result in higher population numbers, but doing so would compromise the ability of the capture, test, and slaughter program to separate tested and untested bison. Potential contact with infected animals could increase the

number of bison testing seropositive and therefore increase the number sent to slaughter when capture operations were resumed. Populations would not be expected to drop to 580 animals, the minimum number needed (based on current data) to maintain genetic viability. If the bison population approached this number, capture and slaughter operations would slow or cease until the population recovered.

Effects on Free-Ranging Status and Distribution of Bison. Under this alternative bison would not be permitted to move outside Yellowstone National Park boundaries. During the anticipated three-year capture period, a minimum of 95% of the bison within the park would be captured and tested for exposure to brucellosis. Those testing negative and released into the park during the final year would be visibly marked to facilitate removal of the remaining untested animals. Several areas in the park would be likely to have few to no bison following the three years of capture, test, and slaughter, and this condition could last as long as 10 years following the final year of captures. Bison movements toward the winter range as well as distribution and overwintering within the park by bison would likely be affected.

Seroprevalence in the Bison Population. The effects of vaccination were calculated at two levels of efficacy, 70% and 25%. The seroprevalence rate in bison under this alternative would be expected to drop from 50% in 1997 to 0% in 2001, assuming 70% vaccine efficacy and whole-herd vaccination (see table 37). In the 25% vaccine efficacy model, the seroprevalence rate also dropped to 0% by 2001. This seroprevalence rate was lower than that predicted by Peterson, Grant, and Davis (1991) in simulations of test, slaughter, and vaccination of Grand Teton National Park bison. The difference could be a result of the Grand Teton model assuming a higher transmission rate (to reflect higher initial seroprevalence rates, the additive influence of feedlot elk on the bison seroprevalence rate, etc.; these conditions are not present in the Yellowstone population).

No information was available about the transmission rate among Yellowstone bison, or between Yellowstone elk and bison. Few data exist regarding the proportion of bison exhibiting false negative tests or becoming newly infected each year. Assuming that sources of infection still existed in the park following three to five years of extensive capture, test, and slaughter operations, some bison might become reinfected. Calfhood vaccination was assumed to continue in this alternative, which might reduce the risk of infection. Other factors, such as whole-herd vaccination, multiple-dose vaccination, protection from abortion, and the observed rarity of abortions in the Yellowstone bison population might all contribute to a low risk of the bison population becoming reinfected in this alternative.

Stochastic Influence on Bison Population. Under this alternative all bison exiting the park would be captured and sent to slaughter. Up to 108, 236, or 975 bison (100% of those exiting) could be removed under the predicted range of exit numbers. Efforts could be undertaken to haze bison back inside the boundary in order to reduce the number of bison removed from the population. However, during the capture phase of this alternative (three years), large migrations would not be expected.

Cumulative Impacts

During the first five years of alternative 5, total management removals would range from 0.4% to 48% of the bison population and average 14%. Cumulative impacts as described in "Cumulative Impacts Common to All Alternatives" would add to decreases in the population.

Conclusion

The bison population would rapidly decline under this alternative, representing a major reduction of 47% over a period of only three years. More than 95% of the bison in the park would be rounded up and handled in capture

TABLE 37: ESTIMATED EARLY WINTER POPULATION, RATE OF POPULATION INCREASE, PROJECTED MANAGEMENT REMOVALS, AND ESTIMATED SEROPREVALENCE RATE FOR THE BISON POPULATION UNDER ALTERNATIVE 5

			Management Removals Outside Yellowstone National Park				
Year	Early Winter Population	Yearly Percent Increase	North Boundary	West Boundary	Total Removals[1]	Remaining on Public Land Outside YNP at West	Estimated Percent Sero-prevalence[2]
1997	2,156				110		50
1998[3]	2,214	2.7			1,052		50
1999	1,257	-43.2			56		4.7
2000[4]	1,299	3.3			4		0.3
2001	1,401	7.8			65		0
2002[5]	1,446	3.1					0
2003	1,565	8.2					0
2004	1,693	8.2					0
2005	1,832	8.2					0
2006	1,982	8.2					0
2011	2,940						0
MEAN		0.7					

1. In 1997, all bison exiting at West Yellowstone are removed. In years 1998–2001, total bison removals are from capture, test, and slaughter operations.
2. Seroprevalence of the population just prior to early winter capture, test, and slaughter operations.
3. Beginning of three-year capture, test and slaughter.
4. Beginning of whole-herd vaccination, at 70% efficacy in 2000
5. Beginning of no lethal management, but continued calfhood vaccination.

facilities, with the remainder being shot at the end of the three-year capture period.

Bison would not be free-ranging during the capture period, although negative-testing bison would be set free immediately after capture and vaccination. All seronegative bison would be marked to facilitate future testing and post-capture shooting operations. The extensive capture operation, as well as confinement to the park might detract from the wild, free-ranging qualities of the bison population during the three- to four-year period these actions were in effect. This alternative would have a major impact on the distribution of bison. Bison would not be allowed outside Yellowstone National Park, and many areas within the park where bison have previously existed would be expected to have few or no bison for as long as 10 years.

This alternative would have a major impact on seroprevalence rate in bison, decreasing the proportion of seropositive bison from 50% to approximately 0% by the year 2001. Continued vaccination of bison with a safe and effective vaccine would be expected to maintain a low seroprevalence rate for the long term.

IMPACTS OF ALTERNATIVE 6

Analysis

Effects on the Bison Population. For alternative 6, the agencies would attempt to manage the Yellowstone bison population within the range of 1,700 to 3,500 animals. In this alternative, whole-herd vaccination would be used initially to reduce the seroprevalence rate in the bison population. After the seroprevalence

rate has appeared to stabilize, capture, test, and slaughter operations as described in alternative 5 would remove the remaining seropositive animals. For this analysis, the capture, test, and slaughter operations occurred after 10 years of vaccination. In calculating the impacts on the bison population, the effects of vaccination were calculated at 70% and 25% efficacy, and, as in all other alternatives, assumed to begin in the year 2000. The model assumed 95% of total bison population was vaccinated each year. The seroprevalence rate for unvaccinated and vaccinated but unprotected calves was assumed to be equal to the seroprevalence in the adult population for that year.

Scenario A – 70% Vaccine Efficacy — The bison population would be expected to increase from 2,100 to approximately 3,100 animals in 2006 (average increase 4.2%; see table 38) and 3,500 by 2010. Bison population numbers would be controlled through capture and removal of all bison leaving Yellowstone National Park at Reese Creek, and removal of seropositive bison moving west near the Seven-Mile Bridge area in the park. Bison would not be expected to move beyond the identified management area, but if they did, they would be removed by agency shooting, usually within the park. Implementation of capture, test, and slaughter operations was assumed to begin in 2010 after 10 years of vaccination. Assumptions used for this portion of calculations were as described under the impacts of alternative 5. This stage of operations resulted in a reduction of the bison population from about 3,500 in 2010 to 2,900 in 2011, followed by an increase to 3,400 by 2014.

Alternatives 6 and 4 differ on the west side in that seronegative-pregnant female bison would be slaughtered in alternative 4, but released in alternative 6 for the first phase. By the year 2006, modeling predicted the population in alternative 6 would have reached 3,100, whereas implementation of alternative 4 would result in only about 2,800 animals. Much (but not all, as limited hunting would be a part of alternative 4 as well) of the difference in population sizes in these two alternatives would be a result of the release of seronegative females.

Winter range management objectives would allow up to 100–200 bison in Eagle Creek/Bear Creek, 0 in the Reese Creek area, and up to 50–100 seronegative bison in the West Yellowstone area. Approximately 20–60 seronegative bison were predicted to winter in the West Yellowstone area.

Scenario B – 25% Vaccine Efficacy — During the 10-year vaccination phase, the bison population would be expected to increase from 2,100 to approximately 3,100 animals in 2006 (average increase 4.2%; see table 39). During this 10-year period, bison population numbers would be controlled as described under the 70% vaccine efficacy model. Implementation of the capture, test, and slaughter program would begin in 2010 and reduce the population from 3,500 to approximately 2,500 bison in 2011, followed by an increase to 3,000 animals by 2014. The lower number of bison estimated in this model would be a result of more bison being slaughtered because of the lower vaccine efficacy.

Effects on Free-Ranging Status and Distribution of Bison. Management actions under this alternative would not be expected to appreciably alter the age/sex structure of the bison population for either vaccine efficacy. Bison would be allowed to freely range in the Eagle Creek/Bear Creek area, and seronegative bison would be allowed to range in the West Yellowstone area. During the three-year capture, test and slaughter phase, a minimum of 95% of the bison within Yellowstone National Park would be rounded up and tested for exposure to brucellosis. Those testing negative and released into the park would be visibly marked to facilitate removal of the remaining untested animals.

Seroprevalence in the Bison Population. The seroprevalence rate of bison would be expected to decline from a starting point of 50% seropositive in 1997 to at least 27% at 70% vaccine efficacy or to 36% at 25% vaccine efficacy by 2009 (10-year vaccination period). After 10 years of vaccination, the capture, test, and slaughter operations were assumed to begin in 2010. After four years of capture and removal of all seropositive bison (and removal of

Table 38: Estimated Early Winter Population, Rate of Population Increase, Projected Management Removals, and Estimated Seroprevalence Rate for the Bison Population under Alternative 6 at 70% Vaccine Efficacy

			Management Removals Outside Yellowstone National Park				
Year	Early Winter Population	Yearly Percent Increase	North Boundary	West Boundary	Total Removals[1]	Remaining on Public Land Outside YNP at West	Estimated percent Sero-prevalence[2]
1997	2,156		--	55	55	55	50
1998	2,273	5.4	--	56	56	60	49
1999	2,399	5.5	81	20	101	22	47
2000[3]	2,486	3.6	84	19	103	24	47
2001	2,578	3.7	87	19	106	26	44
2002	2,675	3.8	90	18	108	28	42
2003	2,777	3.8	93	18	111	30	39
2004	2,885	3.9	97	17	114	33	37
2005	2,998	3.9	101	17	118	35	34
2006	3,116	3.9	105	17	122	37	32
2007	3,240	4.0	109	16	125	40	30
2008	3,370	4.0	113	16	129	42	28
2009	3,500		118	15	133	46	27
2010[4]	3,500				826	46	25
2011	2,893	-17.3			45	49	1.6
2012	3,082	6.5			2	53	0.1
2013	3,333	8.1			154	58	0
2014	3,440	3.2			0	60	0
MEAN[5]		4.2					

1. From 1997 to 2006, removals included all seronegative and seropositive bison exiting the north boundary (Reese Creek) and seropositive bison captured at the west boundary area (Seven-Mile Bridge area). In years 2010–2013, total removals included seropositive and untested bison removed in capture, test, and slaughter operations.
2. Seroprevalence of the population just prior to early winter operations.
3. Whole-herd vaccination beginning in 2000 and 70% vaccine efficacy.
4. Capture, test, and slaughter operations begin 2010 and end 2013.
5. Average rate of increase from 1997 to 2006.

Table 39: Estimated Early Winter Population, Rate of Population Increase, Projected Management Removals, and Estimated Seroprevalence Rate for the Bison Population under Alternative 6 at 25% Vaccine Efficacy

			Management Removals Outside Yellowstone National Park				
Year	Early Winter Population	Yearly Percent Increase	North Boundary	West Boundary	Total Removals[1]	Remaining on Public Land Outside YNP at West	Estimated percent Sero-prevalence[2]
1997	2,156		--	55	55	55	50
1998	2,273	5.4	--	56	56	60	49
1999	2,399	5.5	81	20	101	22	47
2000[3]	2,486	3.6	84	20	104	23	47
2001	2,577	3.7	87	20	107	25	46
2002	2,673	3.8	90	20	110	26	44
2003	2,773	3.7	93	20	113	28	43
2004	2,878	3.8	97	21	118	29	42
2005	2,986	3.9	101	21	122	31	41
2006	3,099	3.8	104	21	125	33	40
2007[4]	3,218	3.8	108	21	129	35	38
2008	3,342	3.9	117	21	133	37	37
2009	3,472	3.9	117	21	138	39	36
2010	3,500				1168	39	35
2011	2,523	-27.9			63	43	2.6
2012	2,662	5.5			3	46	0.1
2013	2,877	8.1			133	50	0
2014	2,969	3.2			0	51	0
MEAN[5]		4.1					

1. From 1997 to 2009, removals included all seronegative and seropositive bison exiting the north boundary (Reese Creek) and seropositive bison captured at the west boundary area (Seven-Mile Bridge area). In years 2010–2013, total removals included seropositive and untested bison removed in capture, test, and slaughter operations.
2. Seroprevalence of the population just prior to early winter operations.
3. Whole-herd vaccination beginning in 2000 and 25% vaccine efficacy.
4. Capture, test, and slaughter operations begin 2010 and end 2013.
5. Average rate of increase from 1997 to 2006.

untested bison) throughout the park, the seroprevalence rate would decline to 0 for both vaccine efficacies. This model result would likely be due to whole-herd vaccination for 10 years followed by capture, test, and slaughter, and would be similar to alternative 5 in that seroprevalence was predicted to be 0% in 2011.

Stochastic Influence on Bison Population. Under this alternative, all bison exiting the north boundary and all seropositive bison exiting the west boundary would be captured and sent to slaughter, resulting in removal through shipment to slaughter of approximately 83% of bison exiting the park. Therefore, if 108 bison exited the park, roughly 90 would be sent to slaughter and 18 seronegative bison would be allowed to winter on public lands in the West Yellowstone area (see table 31). If 236 bison exited the park, roughly 196 would be sent to slaughter and 40 seronegative bison would be allowed to winter on public lands in the West Yellowstone area (see table 32). If 975 exited the park, roughly 810 would be sent to slaughter and 165 seronegative bison would be released into the West Yellowstone area. This alternative would allow up to 50–100 bison to winter in that area. Therefore, in this scenario, up to 65 additional bison might be removed through shipment of seronegative bison to slaughter, or through agency shooting. A total of up to 875 bison (90% of those exiting the park) could be removed from the population (see table 32).

Cumulative Impacts

Under alternative 6, bison management removals during the 10-year vaccination phase (through 2009) would average between 3.8% at 70% vaccine efficacy and 4.0% at 25% vaccine efficacy of the bison population. In the capture, test, and slaughter phase, removals would average 7.5% at 70% vaccine efficacy to 10.2% at 25% vaccine efficacy of the bison population from 2010 to 2013. Cumulative impacts as described in "Impacts Common to All Alternatives" would add to decreases in the population.

Conclusion

During the vaccination phase of alternative 6, the bison population would be expected to increase an average of 4.2% each year, a negligible to minor increase compared to alternative 1 (less than 10% difference). After the capture, test, and slaughter phase began in 2010, this alternative would result in a moderate (17% decrease, 70% vaccine efficacy) to major reduction (28% decrease, 25% vaccine efficacy) in the bison population.

Bison would not be free ranging for a short time during the capture, test, and slaughter period. This alternative would likely have a minor to moderate impact on bison distribution, by limiting the number of bison allowed outside Yellowstone National Park and by temporarily removing bison from some areas within the park where they previously existed.

This alternative would have a similar impact on seroprevalence rate for the initial 10 years of vaccination, compared to alternative 1. Following capture, test, and slaughter, the reduction in seroprevalence rate would be major, decreasing to 0.

IMPACTS OF ALTERNATIVE 7: PREFERRED ALTERNATIVE

Analysis

Effects on the Bison Population. Assumptions used in alternative 1 were also used in this alternative to construct bison population dynamics. Unlike the other alternatives, the agencies would attempt to manage the bison population within a range of 1,700 to 2,500 in alternative 7. This alternative would emphasize capture of bison at Stephens Creek (or at a facility north of Reese Creek if additional lands were purchased), shipment of seropositive bison to slaughter, and shipment of seronegative bison to quarantine. If populations were high and/or quarantine space was unavailable, seronegative bison would be shipped to slaughter. If the population was near the low range (1,700), seronegative bison could

be held at the capture facility and released in Yellowstone National Park in spring rather than quarantined. Hunting would be used to control populations in the Eagle Creek/Bear Creek area. Capture operations would occur in the West Yellowstone area, and only seronegative males and seronegative-nonpregnant females would be released on public lands in the West Yellowstone area. Seropositive bison would be shipped to slaughter, and seronegative-pregnant females would be shipped to quarantine. Low levels of hunting were assumed in the West Yellowstone area as an adjunct to capture operations. Property north of the park in the Gardiner Valley might be acquired from willing sellers through purchase, easement, or leases. If so, limited hunting could be allowed here as well.

When the bison population was approaching or above 2,500 animals, management efforts would emphasize additional lethal controls. These controls would include shipment of additional seropositive and seronegative bison to slaughter, shipment of seronegative bison to quarantine, increased hunting, and agency shooting outside the park. However, these actions could only occur in response to the movement of large numbers of bison to or beyond the park boundary.

Hunting would begin in 2000, and quotas would provide for a minimum of 15 permits in the Eagle Creek/Bear Creek area. It was also assumed a total of 10 permits would be offered in the West Yellowstone area beginning 2002 as an adjunct to capture operations and 10 (if approved) in the Reese Creek SMA. Based on bison population numbers, winter distribution on public and private lands, and other factors, the agencies could conduct additional special drawings to harvest additional bison.

Under this alternative, bison population numbers would be controlled through capture, shipment of seropositive bison to slaughter, shipment of seronegative bison to slaughter or quarantine, hunting, and agency shooting outside the park. Modeling predicts this alternative would initially result in a small increase in the bison population, and assumes management actions (increased removals) would limit the total population to approximately 2,500. This alternative would be expected to result in lower long-term population levels than any of the other alternatives except alternative 5. From 1997 to 2004, the bison population would be expected to increase from about 2,100 bison to 2,700 bison (average increase of 2.6%/year; see table 40) where it would remain over the life of the management plan. At 10 years and assuming 70% vaccine efficacy, population levels under alternative 7 would be about 12% lower than alternative 1. The population would be 23% lower by 2011. However, because of the limitations of the deterministic model discussed previously, the differences between alternatives 1 and 7 could be less. This might result because more bison could be removed in alternative 1 than that displayed in the analysis. The agencies would expect severe winter conditions to periodically force additional bison outside park boundaries. When these conditions occurred and the early winter bison population was near or above 2,500 animals, this alternative would require the agencies to ship additional bison to slaughter or quarantine, increase hunter harvest, or increase agency shooting outside the park to maintain the spring bison population below or near 2,500. If the assumptions of the model proved true (e.g., average winters and average number of bison exiting), such removals would begin in the year 2003. Average removals from slaughter, quarantine, and hunting were predicted to remove between 132 and 137 bison each year. The agencies would expect to remove 42–73 additional bison each year as they moved outside the park boundary at the north boundary and West Yellowstone areas, for total annual removals of 179–205 bison.

Management actions in this alternative would not measurably affect the age/sex distribution or reproductive rates of the Yellowstone bison population. Capture operations, shipment of bison to slaughter and quarantine, limited hunting, agency shooting outside the park, and periodic severe environmental conditions would likely maintain the spring bison population near 2,500.

Effects on Free-Ranging Status and Distribution of Bison. Bison would not be expected to move beyond the identified SMA, but if they did, they would be removed. If the bison population approached the low range (1,700), efforts would be made to haze bison back into the SMAs. Agency personnel would shoot bison or haze them off private lands where the landowner wanted bison removed and hunting was not allowed.

Management objectives would allow 100–200 bison to freely range in the Eagle Creek/Bear Creek area. Approximately 100 bison would be expected to winter in this area. Beginning in the year 2000, an annual hunter harvest of 15 animals would be expected in the Eagle Creek/Bear Creek area. Bulls would likely be harvested in this area.

Initially, no bison would be allowed in the Reese Creek area. If additional lands were purchased, management objectives would allow up to 50–100 bison in the Reese Creek area, although the total number of animals in the entire bison population would not be increased.

Management objectives would allow up to 50–100 seronegative male and seronegative-nonpregnant female bison in the West Yellowstone area and 14–51 animals would be expected. Beginning in 2002, annual hunter harvests of 10 bison would likely consist of males, but some larger females could also be taken. Following hunter harvests and potential additional removals that might be required to manage the population at 2,500 animals, few if any bison would winter in the West Yellowstone area during the life of the plan (see table 40).

Seroprevalence in the Bison Population. The population seroprevalence rate would be expected to decline from a starting point of 50% seropositive in 1997 to at least 32% seropositive in 2006 due to removal of seropositive bison in the West Yellowstone and Reese Creek area and vaccination at 70% efficacy beginning in 2000 (see table 40). Continued management efforts and vaccination at 70% efficacy would reduce seroprevalence to 23% in 2011. With vaccination and a vaccine efficacy of 25%, seroprevalence was predicted to drop from 50% to 40% by 2006.

Stochastic Influence on Bison Population. In phase 1, this alternative would feature capture and shipment to slaughter of all bison exiting at the north boundary and all seropositive and seronegative-pregnant bison exiting at the west boundary. During the first two years after implementation, the number of bison removed through shipment to slaughter would be the same (85% of the total bison exiting the park) as under alternative 1.

During phase 2 of this alternative, quarantine, hunting, and land acquisition would likely occur. If lands were acquired, bison exiting the north boundary would be allowed to roam in the Reese Creek SMA, where some could be hunted. Capture operations in the West Yellowstone area would continue to send seropositive bison to slaughter, and seronegative-pregnant bison to quarantine. Seronegative-nonpregnant bison would be released on public lands in the West Yellowstone area, where some could be hunted. In this phase, if 108 bison exited the park, 19 would be sent to slaughter, 3 would be sent to quarantine, and 15 seronegative-nonpregnant bison would be released and could winter on public lands in the West Yellowstone area. Ten of those bison could be hunted. Approximately 72 bison would exit into the Reese Creek SMA and 10 bison could be hunted. Approximately 62 could winter in the Reese Creek SMA. A total of 42 bison (39% of the bison exiting the park) could be removed from the population (19 to slaughter, 3 to quarantine, and 20 through hunting); see table 31. If the early winter bison population numbered between 2,400 and 2,600 and 108 bison exited the park, 100% of the bison would be removed to keep the bison population below 2,500 animals. If 236 bison exited the park, 41 would be sent to slaughter, 6 to quarantine, and 34 seronegative-nonpregnant bison would be released and could winter on public lands in the West Yellowstone area. Ten of those bison could be hunted. Approximately 156 bison would exit into the Reese Creek SMA and 10 bison could be hunted. Approximately

Table 40: Estimated Early Winter Population, Rate of Population Increase, Projected Management Removals, and Estimated Seroprevalence Rate for the Bison Population under Alternative 7

			Management Removals Outside Yellowstone National Park				
Year	Early Winter Population	Yearly Percent Increase	North Boundary[1]	West Boundary[2]	Total Removals	Remaining on Public Land Outside YNP at West	Estimated Percent Sero-prevalence[3]
1997	2,156		--	55	55	48	50
1998	2,266	5.1	--	57	57	51	49
1999	2,381	5.1	80	23	103	18	48
2000	2,465	3.5	98	23	121	20	47
2001	2,536	2.9	100	23	123	21	45
2002	2,611	3.0	103	32	135	13	42
2003	2,679	2.6	105	32	179[4]	14	39
2004	2,705	1.0	106	31	205[5]	16	37
2005	2,705	0.0	106	30	205	17	34
2006	2,705	0.0	106	29	205	18	32
2011	2,705						23
MEAN[6]		2.6					

1. Totals include seropositive and seronegative bison captured at Stephens Creek facility and sent to slaughter, and 15 bison hunted at Eagle Creek/Bear Creek beginning in 2000.
2. Totals include seropositive and seronegative-pregnant bison captured in the West Yellowstone area and sent to slaughter and 10 bison hunted in the West Yellowstone area beginning in 2002.
3. Based on calfhood vaccination beginning 2000 and 70% vaccine efficacy.
4. Includes additional opportunistic removal of 42 bison that are exiting Yellowstone National Park at the north boundary or West Yellowstone areas.
5. For the years 2004 to 2006, includes additional opportunistic removal of 68–70 bison that are exiting Yellowstone National Park at the north boundary or West Yellowstone areas.
6. Mean rate of increase calculated from 1997 to 2006.

50–100 bison could winter in the Reese Creek SMA and the agencies could remove an additional 36 bison through capture and shipment to slaughter, quarantine, additional hunting, or agency shooting. A total of 67–103 bison (28%–44% of the bison exiting the park) could be removed from the population (41 to slaughter, 6 to quarantine, 20 through hunting, plus an additional 36 from the Reese Creek SMA to slaughter, quarantine, hunting, or agency shooting); see table 32.

If the early winter population numbered between 2,500 and 2,700, and 236 bison exited the park, 100% of the bison would be removed to keep the bison population less than 2,500. If the early winter population was greater than 2,500 bison, and fewer than 236 left the park, it would not be possible to maintain the herd below 2,500 bison. If 975 bison exit the park, 166 would be sent to slaughter, 23 would be sent to quarantine, and 143 seronegative-nonpregnant bison would be released and could winter on public lands in the West Yellowstone area. Ten of those bison could be hunted. Approximately 50–100 bison could winter in the West Yellowstone area (Horse Butte) and the agencies could remove an additional 33 bison through capture and shipment to slaughter quarantine, additional hunting, or agency shooting. Approximately 643 bison would exit into the Reese Creek SMA and 10 bison could be hunted. Should capture and

testing of bison occur in the Reese Creek SMA because of the large number of remaining bison (633), approximately 316 seropositive bison would be sent to slaughter with 317 seronegative bison remaining. Approximately 50–100 bison could winter in the Reese Creek SMA and the agencies could remove an additional 217 bison through capture and shipment to slaughter, quarantine, additional hunting or agency shooting. A total of 209–775 bison (21%–79% of the bison exiting) could be removed from the population under this scenario (166 to slaughter, 23 to quarantine, 20 through hunting, plus an additional 33 in the West Yellowstone area and 533 in the Reese Creek SMA to slaughter, quarantine, additional hunting, or agency shooting); see table 33. If the early winter bison population numbered between 3,275 and 3,500, and 975 bison exited the park, this alternative would require the agencies to remove 100% of the exiting bison to reduce the population below 2,500 animals.

Cumulative Impacts

For alternative 7, total management removals would average about 5% of the total bison population from 1997 to 2002. Beginning in 2003, additional removals would be required to manage the bison population near 2,500 animals, and these removals would average about 7.6% of the early winter population. These removals would be in addition to those described in "Cumulative Impacts Common to All Alternatives."

Conclusion

This alternative would maintain the bison population within the range of 1,700 to 2,500 animals. Capture operations, shipment of bison to slaughter or quarantine, limited hunting, agency shooting outside the park, and periodic severe environmental conditions would likely maintain the population near 2,500 bison. It was estimated this alternative would result in a moderate decrease (12%) in the bison population by 2006 and a major decrease (23%) by 2011 compared to alternative 1. Because of the limitations of the deterministic model, the differences between alternatives 7 and 1 might be less.

This alternative would allow bison to freely range within Yellowstone National Park except in the Stephens Creek area. Approximately 100–200 could freely range in the Eagle Creek/Bear Creek SMA, and up to 50–100 in the Reese Creek SMA if additional winter range was acquired. After capture and removal of seropositives, and hunting, few if any bison would be expected to winter in the West Yellowstone area.

Capture and removal of seropositive bison and calfhood vaccination at 70% efficacy were predicted to decrease seroprevalence to at least 32% in 2006 and 23% by 2011. This would be a negligible to minor decrease in seroprevalence compared to that predicted to occur if alternative 1 was implemented.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

No irreversible (long term or permanent) commitments of the bison population were identified in any of the alternatives.

Irretrievable (short term or reversible) commitments of 13 acres of winter habitat are identified in alternatives 1, 4, 5, and 6. Under these alternatives, bison would be prevented from using a small amount of public land in the Reese Creek area, north of Yellowstone National Park because private land would be immediately adjacent to the park and would be grazed by domestic cattle. Also, in alternatives 1, 3 (short term), 4, 5, 6, and 7 (short term), 13 acres of winter range habitat inside Yellowstone National Park in the Stephens Creek area would be unavailable to bison because of the management actions to capture bison at the Stephens Creek facility. In alternative 5, bison would not be allowed to use any public land beyond Yellowstone National Park boundaries. For alternatives 1, 3, 4, 6, and 7 bison would be

prevented from occupying public lands (primarily in the West Yellowstone area) from about May 1 through October 31.

No irretrievable commitments to the bison population were identified. Irretrievable commitments of resources would include only those individual bison killed as part of management actions (capture and shipment to slaughter or agency shooting) that might have otherwise survived.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

None was identified for the bison population in alternatives 1 through 6. In alternative 7, the agencies would manage the bison population to approximately 2,500. This could represent a loss in long-term availability compared to the ecological potential of the Yellowstone ecosystem. The long-term ecological potential would average 2,700 and fluctuate between 1,700 and 3,500 bison. No short-term gain for the bison population was identified in alternative 7.

UNAVOIDABLE ADVERSE IMPACTS

Although individual bison from a brucellosis-affected herd would be killed in each alternative, all alternatives except alternative 5 would maintain the population within the 1,700 to 3,500 range. In alternative 5, the bison population would be quickly reduced to about 1,300 animals and would not recover to the low end of the range (1,700) until after 2005. However, this alternative would not lower the population to levels where genetic population viability concerns might be expected. In alternative 7, the bison population would be managed to maintain it between 1,700 and 2,500 animals.

In alternative 5, bison distribution would be limited only to Yellowstone National Park. Agency personnel would shoot any bison found on public or private lands outside the park. In alternative 5, bison could be absent in some areas and habitats that were previously occupied.

Bison skull, by J. R. Douglas, 1969. (NPS photo)

SUMMARY OF REGULATIONS AND POLICIES

The Act of March 1, 1872 (17 Stat. 32, 16 U.S.C. 22) established Yellowstone National Park and states it is "dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people." The Act of August 25, 1916 (Public Law 64-235, 39 Stat. 535, 16 U.S.C. 1-3) established the National Park Service and states its basic mission: "[T]o conserve the scenery and natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as would leave them unimpaired for the enjoyment of future generations." The *Yellowstone National Park Master Plan* (1974) requires that wildlife management actions be directed toward reducing or eliminating disruptive human influences, relying, whenever possible, upon natural controls to regulate animal numbers.

METHODOLOGIES FOR ANALYZING IMPACTS

Impacts on recreation users and facilities were based on a literature review of previous planning, management, and social and economic literature concerning the topics at issue, including the Yellowstone National Park visitor experience, wildlife viewing, winter recreation, and hunting as referenced in the "Affected Environment" and following sections. No original data collection was undertaken as part of this environmental impact statement.

In evaluating impacts on recreation, four areas of potential impact were analyzed: overall visitor use and experience, bison viewing, winter recreation, and hunting. In analyzing impacts on the overall visitor use and experience, particular attention was paid to information and data on potential visitation restrictions or other visitor impacts related to bison management actions. Data on anticipated bison population levels were primarily used in estimating impacts on bison viewing. Estimates of impacts on winter recreation were developed based on anticipated changes in winter access to the park under each alternative. Lastly, impacts on hunting were estimated based on anticipated levels of permits for bison hunting issued under several of the alternatives.

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

The gray wolf was reintroduced into the Yellowstone area in 1995. Currently, nine breeding pairs inhabit the Greater Yellowstone Area, mostly within park boundaries. Wolves are one of the top 10 mammals visitors come to the area to view, and their reintroduction has had a positive impact on their recreational experience in many cases. This would be an added benefit in alternatives where bison viewing opportunities would increase, and somewhat offsetting where the number of bison and relative chance to view them would decrease.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Overall Visitor Use and Experience. Alternative 1 would be expected to have a substantial number of bison slaughtered or shot at both the north and west entrances; the annual average was estimated at 103. These management actions, as well as the presence of capture facilities, might affect recreational opportunities in the following ways: (1) use of areas by visitors might be restricted while bison management activities were taking place, and (2) visitors might react to seeing management activities either positively or negatively (curiosity or negative emotional response). Some visitors might be attracted to the Stephens Creek capture

facility or SMAs to see the bison and capture activities.

Alternative 1 would have the potential to restrict visitor use at or near the capture facilities during winter months when bison were occupying the areas and bison management activities are occurring. These areas might be closed for periods ranging from one day to weeks, depending on the number of bison, weather conditions, and other factors. Recreation on the balance of the park, forest, and state wildlife management area lands in the analysis area would not be restricted through the implementation of alternative 1.

Bison Viewing. The various alternatives evaluated in this environmental impact statement would affect wildlife viewing primarily by affecting bison distribution throughout the park and adjacent areas and by affecting bison population numbers. Continued implementation of alternative 1 would not likely affect the overall distribution of bison in the park. Alternative 1 would be expected to result in a 4% increase of the bison population per year to an estimated 42% increase over the status quo (currently about 2,156 animals including calves) to 3,066 animals by the year 2006. This would be a positive impact relative to current population levels.

Winter Recreation. Alternative 1 would not affect winter recreation.

Hunting. There would be no hunting of bison under alternative 1.

Cumulative Impacts

Continued implementation of alternative 1 would have a positive impact on bison viewing relative to the status quo. It would have a minor negative impact on the overall visitor experience due to the presence of management actions and capture facilities. These impacts would probably be slight compared to or in addition to other ongoing changes.

Conclusion

Continued implementation of alternative 1 would likely have offsetting minor positive and negative impacts on recreation relative to the status quo.

IMPACTS OF ALTERNATIVE 2

Analysis

Overall Visitor Use and Experience. Because alternative 2 would include no capture facilities or management actions relative to bison slaughter, there would likely be no adverse impacts on the overall park visitor experience during phase 2.

During phase 1 of alternative 2, a substantial number of bison would likely be shot or slaughtered. In phase 2 of implementation of alternative 2, the number of bison shot or slaughtered would likely be negligible except during severe winters.

Bison Viewing. Alternative 2 would be expected (by 2006) to increase to a population of 3,500 bison, 14% larger than in alternative 1, and 62% higher than current levels. Growth is then expected to level out, and by 2011, the estimated bison population under alternative 2 would be roughly the same as under alternative 1. If this alternative were selected, bison could be relatively common outside the park at certain times of the year. As bison spread from the park, they might attract more visitors to the area

There have been no studies to date that explicitly focused on the impact of changes in bison populations on visitation levels or the park visitor's experience, although there have been studies on other large ungulates such as elk that have been used to demonstrate impacts that would be similar to bison viewing. In Duffield (1991a) a 20% increase in elk populations was estimated to have a minor to moderate positive effect on the park visitor experience. It would be likely that any increase in visitation in response to increased bison numbers would be less than

the visitation change expected to occur from having wolves in the park (as wolves are named by some visitors as the wildlife species they are most interested in seeing when they visit the park). This change has been estimated to be about a 5% increase in overall park visitation, or about 135,000 additional visitors per year (USFWS 1994). The latter increase would likely occur mostly in the summer months, but for perspective is roughly equivalent to the current level of winter visitation. This would be a minor to moderate positive impact relative to alternative 1.


Bison with snowmobilers.

Winter Recreation. Alternative 2 would call for the elimination of winter snow grooming on approximately 60 miles of park roads (West Yellowstone to Madison Junction, Madison Junction to Mammoth, Madison Junction south to Fountain Flats). This closure would have the effect of eliminating oversnow travel from the town of West Yellowstone to Madison Junction and therefore also on to all points north and south from Madison. Also, oversnow access from Mammoth Hot Springs south to Madison Junction could be eliminated. Oversnow vehicles could still enter the park at the south and east entrances for access to the popular destination of Old Faithful. Currently a majority of winter travel into Yellowstone National Park enters from the west and north entrances (47% and 32% of total winter visitation, respectively). Only a portion of the winter visitors using the north entrance also use the road proposed for closure (Mammoth to Madison Junction). Still, the proposed road and trail closures would likely affect well over 50% of current winter oversnow visitors to the park and either displace their activities to other roads and trails in the area or, in the case of some nonresident visitors, cause them to go to areas other than the greater Yellowstone area for their winter recreation. This would be a major adverse impact on winter recreationists in the park, but would vary somewhat depending on visitors' satisfaction with alternative trails and access points.

As a result of the road closures, snowmobile use on the Hebgen Lake district might increase by as much as 15% to 34% over 1995–96 levels , if the current use in the park from the west entrance shifted onto the Gallatin National Forest. However, some of this use (which is targeted on visiting Old Faithful) might shift to the south entrance.

The approximately 60 miles of groomed roads slated for closure under this alternative represent approximately 30% of the groomed roads within the park, and perhaps 10% of the groomed trails in and out of the park in the areas near West Yellowstone. Estimates of the economic impact associated with park road closures under this alternative are detailed in the "Impacts on Socioeconomics."

Hunting. There would be no hunting of bison under alternative 2.

Cumulative Impacts

Under alternative 2, the potential positive impact on summer use would be larger but more uncertain than the potential negative impact on winter recreation. It is possible, therefore, that the two impacts could be roughly offsetting. Winter recreationists might experience impacts from winter use decisions now under consideration by the park that have effects in addition to those described in this alternative.

Conclusion

Alternative 2 would have a positive minor to moderate impact on wildlife viewing relative to alternative 1. It would also have a negative minor to moderate impact (in the context of total annual use of the park) due to reduced winter recreation. This would be in the context of total annual use in winter recreation and comprises about 4.5% of the total annual park visitation. These offsetting impacts would lead to a likely negligible overall impact on recreation but a possible moderate to major negative impact on winter recreationists in the park.

IMPACTS OF ALTERNATIVE 3

Analysis

Overall Visitor Use and Experience. Alternative 3 would provide for capture facilities only as a backup to hunting in the long term, with only periodic removals when hunting could not be used. Accordingly, there would likely be negligible impacts on the overall visitor experience from bison capture. During phase 1 of alternative 3, a substantial number of bison would likely be shot or slaughtered. In phase 2 of implementation of alternative 3, the number shot or slaughtered would likely be dramatically reduced, and hunting could be used as the primary population control tool. This presumes that hunting would be approved by the Montana State legislature, the likelihood of which is unknown.

Bison Viewing. Alternative 3 would lead to a growth rate in bison that is about double that of alternative 1 and would lead to a population of 3,500 by 2006, 14% greater than in alternative 1 in this same year and 62% greater than current levels. The impacts of this alternative would therefore be likely to be similar to alternative 2, and constitute a minor to moderate positive impact on viewing relative to alternative 1.

Winter Recreation. Research on the use of groomed roads and trails and effectiveness of closures could lead to changes in road grooming with impacts on recreation users. However, these changes would either be consistent with Yellowstone National Park's winter use plan or involve future NEPA evaluation, and any impact would be analyzed in that evaluation.

Hunting. Under alternative 3, there could be 75 bison hunting permits beginning in 2000 and increasing to 85 permits beginning in 2005. This would be a minor to moderate beneficial impact on hunting as a recreational activity. A discussion of the economic impacts associated with these proposed hunts is discussed in the "Impacts on Socioeconomics."

Cumulative Impacts

The generally positive impacts of alternative 3 on recreation from increases in bison viewing and hunting opportunities would be additive to the positive impacts of wildlife restoration efforts (see "Cumulative Impacts Common to All Alternatives"). The exceptions would be the potential negative effects of winter trail closures.

Conclusion

This alternative would lead to a minor to moderate positive impact on recreation due to minor to moderate increases in viewing opportunities compared to alternative 1, and minor to moderate positive impacts for hunters. Potential winter trail closures could result in a minor to major adverse effect.

IMPACTS OF ALTERNATIVE 4

Analysis

Overall Visitor Use and Experience. Impacts would be similar to alternative 1. During phase 1 of alternative 4, a substantial number of bison would likely be shot or slaughtered. However, in phase 2 of implementation of alternative 4, the number of bison shot or slaughtered would likely be significantly reduced, and hunting would also be used as a population control tool.

Bison Viewing. Alternative 4 would be expected to result in a population of 2,800 by the year 2006, 8% smaller than alternative 1 and 30% larger than current population levels. This would result in a minor adverse impact on bison viewing relative to alternative 1.

Winter Recreation. Alternative 4 would not have an impact on winter recreation.

Hunting. Under alternative 4, there might be 35 bison hunting permits beginning in 2000. This would be a minor positive impact on hunting as a recreational activity. A discussion of the economic impacts associated with these proposed hunts is discussed in the "Impacts on Socioeconomics."

Cumulative Impacts

There would be additive beneficial impacts on recreation users under this alternative. Hunters would experience a minor benefit, which is an additional positive impact on recreation when combined with viewing benefits from wildlife restoration efforts (see "Cumulative Impacts Common to All Alternatives").

Conclusion

This alternative would have a similar impact to alternative 1, except there would be an additional minor positive impact for hunters to have an opportunity to hunt bison.

IMPACTS OF ALTERNATIVE 5

Analysis

Overall Visitor Use and Experience. This alternative would have nine capture facilities operating simultaneously for a period of three years. The total number of bison likely to be slaughtered or shot from 1998 to 2001 would be approximately 1,200 (almost 50% of the total population). Therefore, management actions would be highly visible to park visitors. This could lead to a minor to moderate generally adverse impact on the park visitor experience, depending on the visibility and timing of the actions.

Bison Viewing. Alternative 5 would lead to a substantial, nearly 50%, reduction in bison numbers relative to alternative 1 (and 42% reduction compared to current levels) in the first year of areawide capture and slaughter (1999). Alternative 5 is the only alternative in which the deterministic model predicts the bison population would drop below the current low levels. By 2006, the model estimates bison populations under this alternative would be expected to be 35% lower than under alternative 1, and by 2011, they would be 16% lower. Bison populations would be 8% lower than current levels in 2006, but 36% higher than current levels by 2011. The 35% change relative to alternative 1 in the first 10 years of the management plan would be substantially larger than the relative change in elk populations studied in Duffield (1991a). The latter showed a statistically major adverse effect on the park visitor experience, as presumably would predicted decreases in the bison population in this alternative. This alternative would also likely be the only alternative to possibly affect bison distribution in the park. Given the relative ranking of bison and wolves in visitor preferences to view (see table 14), the effect on visitation could be on the same order as the effect of recovering wolves (5%) but in a negative direction. This 5% decrease in visitation would be a minor adverse effect on wildlife viewing in the context of overall park visitation but a moderate to major adverse impact on bison viewing in Yellowstone National Park.

Winter Recreation. This alternative would require intermittent plowing of some park roads during the winter to transport captured sero-positive bison to slaughter. The impact of alternative 5 on winter recreation would be similar to alternative 2 in that there would be no winter snowmobile access into the park from West Yellowstone. In addition, there would be no snowmobile use from the east entrance (only 3% of the visitor use in the park) and the north entrance (32% of the visitor use in the park).

The effect of this alternative on winter use from the north entrance would be limited, as there would still be access to Norris but not beyond. This alternative would displace a total of about 3,300 winter users. During the three to four years that areawide capture and slaughter was in effect, this alternative would have a major adverse impact on some winter park users. However, this would be a temporary effect, and overall the impact on snowmobile use would be minor to moderate.

Hunting. No hunting would take place under alternative 5.

Cumulative Impacts

Alternative 5 would have a minor to moderate adverse impact on the overall visitor experience from the presence of bison management activities throughout the park. This alternative would have a moderate to major adverse impact on wildlife viewing from decreases in the bison population size relative to alternative 1 during and for several years following the capture and slaughter operations.

Conclusion

Alternative 5 would have a minor to moderate adverse affect on recreation. Moderate adverse impacts could arise depending on how visitors reacted to the presence of bison management activities and facilities throughout the park. Minor to moderate adverse impacts on displaced snowmobile users would also be likely in the long term.

IMPACTS OF ALTERNATIVE 6

Analysis

Overall Visitor Use and Experience. Although management activities would be as visible in this alternative as in alternative 5, bison populations would be maintained at much higher levels. Therefore, impacts would likely be somewhat less adverse than, but similar to, alternative 5.

Bison Viewing. Under alternative 6 in the year 2006, bison populations would be 1% higher than alternative 1 and 47% higher than current levels. Impacts on bison viewing would be the same as alternative 1 through the year 2009, and similar to alternative 5 after 2010.

Winter Recreation. This alternative would require plowing to pavement of the road between West Yellowstone and the capture facility at Seven-Mile Bridge inside the park boundary for the first 10 years. This would eliminate snowmobile use on these roads and have impacts on recreationists similar to those described under alternative 2. In the second phase of this alternative, roads inside the park that are now groomed for snowmobile use would be plowed to accommodate transport of sero-positive bison to slaughter. Impacts on winter recreationists would be the same as those described in alternative 5 for the two to three years this phase was in effect.

Hunting. There would be no impacts as hunting is not part of this alternative.

Cumulative Impacts

Alternative 6 would have a minor to moderate adverse impact on the overall visitor experience from the presence of bison management activities throughout the park.

Conclusion

Alternative 6 would have a minor to moderate adverse effect on recreation. Adverse impacts could arise depending on how visitors reacted to the presence of bison management activities and facilities throughout the park. Although bison population numbers would be comparable to alternative 1 and bison viewing would not be adversely affected for the first 12 years of the plan, the capture and slaughter activities in 2010 would adversely affect the overall visitor experience. Major adverse impacts on displaced snowmobile users would also be possible. Minor to moderate adverse impacts would occur overall.

IMPACTS OF ALTERNATIVE 7: PREFERRED ALTERNATIVE

Analysis

Overall Visitor Use and Experience. Impacts under this alternative would be similar to those described in alternative 4. However, during phase 1 of alternative 7, a substantial number of bison would likely be shot or slaughtered. In phase 2, the slaughter of bison could be reduced by the use of quarantine, hunting, and land acquisition, although efforts to maintain the population size at 2,700 or less could result in substantial additional removals if large migrations occurred.

Bison Viewing. Under alternative 7 bison population levels would be expected to be 12% lower than under alternative 1 in 10 years (by 2006) and 23% lower in 15 years (by 2011). Bison population levels would be 25% higher than current levels in both 2006 and 2011. As was found for alternative 5, these population levels would likely result in a minor to moderate negative impact on general wildlife viewing in the park, and a minor to moderate negative impact on bison viewing relative to alternative 1.

Winter Recreation. All major park attractions would still be accessible from all entrance stations. Thus, there would be no impact on winter recreation.

Hunting. Under alternative 7, 15 bison hunting permits might be issued beginning in 2000, and another 10 permits might be issued beginning in 2002. This would be a minor beneficial impact on hunting as a recreational activity. A discussion of the economic impacts associated with these proposed hunts is discussed in "Impacts on Socioeconomics."

Cumulative Impacts

Alternative 7 would have an adverse impact on the overall visitor experience, and minor to moderate adverse impact on bison viewing relative to alternative 1.

Conclusion

The main reason that people come to Yellowstone National Park is to see wildlife. Changes in wildlife population could affect the viewing experience (Duffield 1991). Bison are among the top 10 species visitors want to see (Duffield 1992). Alternative 7 would likely result in the smallest long-term bison population of all alternatives examined. Thus, alternative 7 would have the greatest long-term adverse effect on bison viewing (a minor to moderate effect) of all alternatives.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

From an economic perspective there would be no irretrievable or irreversible commitments of resources affecting recreation under any of the alternatives. Reduced bison herds could grow again and closed roads and trails could be reopened.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

Beyond the life of the plan, the bison population reductions, as modeled for alternative 7, could lead to a long-term decrease in annual bison viewing-related visitation.

UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts on recreation would include reductions in winter snow-mobiling and certain other oversnow travel under alternatives 2, 5, and 6, and reductions in wildlife viewing options under alternatives 5 and 7.

SUMMARY OF REGULATIONS AND POLICIES

The National Environmental Policy Act requires that proposed major federal actions "attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable or unintended consequences." The *National Park Service Management Policies* also require that parks work with local and state communities to "anticipate, avoid, and resolve potential conflicts, to protect park resources, and to address mutual interests in the quality of life for community residents, considering economic development as well as resource and environmental protection."

The Animal and Plant Health Inspection Service (APHIS) is the federal agency with authority for implementation of the national brucellosis eradication program. The program was established in 1940. Cooperators include APHIS, state animal health authorities, and state livestock producers. Montana obtained its brucellosis class-free status in 1985. APHIS anticipates brucellosis will be eradicated from all cattle in the United States by the end of this century. When this occurs, brucellosis in bison and elk in the Greater Yellowstone Area will be the only remaining reservoir of brucellosis in the United States.

In Montana, the Department of Livestock and the Board of Livestock have the statutory and regulatory authority to control diseases that threaten the livestock industry, including explicit statutory and regulatory authority to control bison emigrating from Yellowstone National Park. In addition, the Montana Department of Fish, Wildlife and Parks has statutory authority to assist the Board of Livestock in regulating bison.

The U.S. Forest Service is the federal agency with authority for managing habitat on the national forests. It is responsible for ecological conditions, and as such, makes jurisdictional decisions as to when livestock grazing allotments need modification of stocking rates to give preference to native animal species over domestic livestock. The issue of use of the same national forest grazing allotments by bison and cattle and the associated risk of brucellosis transmission is the jurisdictional responsibility of livestock agencies (APHIS and Montana Department of Livestock) having regulatory authority over animal diseases.

Modifications of livestock operations in alternatives 2, 3, and 7 that involve (1) closing allotments, (2) changing season of use, or (3) changing type of livestock are the responsibility of livestock disease control agencies based on animal disease management mandates. These modifications are done in consultation with the national forest grazing permittees. Final recommendations are presented to the U.S. Forest Service for consideration as potential modifications of allotments management plans and/or livestock grazing permits.

Central to six of the seven alternatives is the establishment of special management areas (SMAs) where certain classes of bison would be allowed to graze during the winter without jeopardizing Montana's class-free status. SMAs could be implemented under current federal regulations, but would require approval of the state of Montana as specified by Montana law.

METHODOLOGIES FOR ANALYZING IMPACTS

As required by NEPA regulations, both direct and indirect impacts on livestock operations are analyzed. Areas of potential direct impact include livestock management (brucellosis testing and vaccinations, conversion from cow-calf operations to raising steers or spayed heifers), land use (modification of public land grazing allotments, private land acquisitions, and easements), and damage by bison

Indirect or secondary effects are those effects that are a result of the action, but are separated in time and space from the triggering action. Indirect effects on livestock operations are those that might occur as a result of the presence of Yellowstone bison in the state (see "Economic Impacts of Brucellosis in Cattle" section in "Purpose of and Need for Action"). All alternatives are designed to address the risk of brucellosis transmission to protect the economic viability of livestock interests in Montana. They do so using various management strategies.

Some of the expected impacts would be experienced sooner than others. Whereas modified testing and vaccinating practices could be undertaken with varying impacts on livestock producers, changes in land use and conversion of livestock enterprises would involve more complex decisions requiring a longer time period. Where data was available, impacts were estimated in dollar ranges.

Indirect effects on the livestock industry could include the perception within the markets where Montana producers sold their product that Montana cattle would be compromised by disease-exposed bison emigrating from Yellowstone National Park. Another area where perception could indirectly affect the marketplace was with respect to SMAs, which could be viewed by animal health authorities as buffer zones for diseased bison leaving Yellowstone National Park. There could also be concerns over the location of quarantine or capture facilities.

IMPACTS COMMON TO ALL ALTERNATIVES

Contact between bison and cattle should not occur as a result of any alternative under normal conditions, and therefore the disease would not be expected to spread from the bison herd in this manner. Disease transmission through persistence of the *Brucella* organism following abortions and births that might occur in the SMAs also should not occur. However, the economic threat of the disease to the livestock industry would come not only from the risk of actual disease spread, but also from perceptual problems associated with the fact that brucellosis was endemic to bison migrating into Montana from Yellowstone National Park.

The presence of SMAs or the operation of a quarantine facility in a brucellosis class-free state could heighten the concerns among state animal authorities that bison management increases the risk of brucellosis transmission from bison to cattle. Under current APHIS regulations a quarantine facility would require a waiver to be constructed within Montana.

Conversely, the following are examples of activities designed to ensure that bison management reduces the risk of transmission: actions that maintain separation of bison and cattle; actions that reduce the incidence of infection (test and removal, vaccination); and, actions that reduce the numbers of bison (shooting, hunting, shipment to quarantine, and shipment to slaughter).

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

While direct costs in terms of brucellosis testing and vaccinating would not be great and sporadic incidents of damage caused by bison would usually not be severe, there is a cumulative impact on livestock producers in terms of perceived risks of grazing cattle to the north and west of Yellowstone National Park. This concern is evident in the recent decision by two producers to no longer graze cattle in the West Yellowstone area. They own highly valued purebred stock, with bulls and bred cows that sell for more than $3,200, and bred heifers that sell for more than $1,500. The greater value of their cattle would make the disease threat unacceptable. For producers with animals of lesser value as well, the perceived risk of brucellosis would be ever present.

Conversely, reduction of perceived risks due to successful accomplishment of any of the alternatives would have a beneficial cumulative impact. Because Yellowstone National Park bison

emigrate into Montana from a herd that contains animals known to be infected with brucellosis, and because all those animals would be exposed to the disease, management control of the bison would be necessary to protect Montana's livestock industry from the known threat of brucellosis.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Brucellosis Testing and Vaccinating. Practically all Montana livestock operations in the vicinity of Yellowstone National Park vaccinate female calves, compared to an estimated statewide average of about 60%. Under alternative 1, producers north and west of the park would continue to vaccinate as at present. As described in the "Affected Environment," brucellosis testing is required by the state of Idaho of cattle 18 months or older that are pastured in the West Yellowstone area, both when entering and leaving Montana. Other testing could take place, in any location, if the Department of Livestock suspected exposure could have occurred.

Including veterinary and handling expenses, it was estimated that vaccination costs for producers would total about $5 to $10 per female calf (with APHIS paying for the ear tags). With about 2,019 cow-calf pairs of cattle grazing to the north and west of Yellowstone National Park (herds located within SMA boundaries for the largest analysis area; see Alternative 2 map), yearly vaccination costs for these producers was estimated to total between $5,050 and $10,100.[1] Presumably, without the perceived threat posed by Yellowstone bison, rates of vaccination in the study area would more nearly match the current statewide rate of about 60%. Therefore, an additional annual cost of about $2,020 to $4,040 (or the 100%–60% = 40% of vaccination costs) would be borne by affected producers.

Brucellosis testing of Idaho herds grazed in the West Yellowstone area was estimated to cost between $7.50 and $15 per head per test, including veterinary charges. This amount is more than the cost of vaccination because vaccinations usually take place after the calves have already been gathered for weaning or other purposes. The rate at which cattle could be tested and the risk of an animal becoming crippled or otherwise injured in the process would depend largely on the handling facilities available. Costs of brucellosis testing twice yearly near Yellowstone National Park was estimated to total between $15,528 and $34,938.[2] Since this testing requirement was not made of Montana producers elsewhere in the state, the cost would be attributable to the perceived threat posed by Yellowstone bison.

Table 41 shows typical cow-calf production costs for the United States and western states. Based on these sets of costs, it was apparent that testing and vaccinating would be relatively minor expenses over the long run. Assuming the higher estimated costs per animal, $10 for vaccinating and $15 for testing, they represented 1.6% and 2.4%, respectively, of average yearly production costs in the western United States. In years of very low cattle prices, however, a producer's profit margin might be as small as, or smaller than, the costs of vaccination and testing. Therefore, although these costs would be minor in the long term, in years of low prices they could represent the difference between profit and loss.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. No impacts would be expected as conversion from cow-calf operations to steer or spayed heifer enterprises would not be part of alternative 1 (the existing plan).

Gallatin National Forest Grazing Allotments. Grazing allotments would remain unchanged under the existing plan.

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1. Estimated cow-calf population of about 2,019 pairs, with about 1,010 female calves: $5 x 1,010 = $5,050, and $10 x 1,010 = $10,100.

2. Estimated West Yellowstone cow-calf population of about 1,294 pairs, with between 80% and 90% tested twice: $7.50 x 1,294 x .8 x 2 = $15,528, and $15 x 1,294 x .9 x 2 = $34,938.

TABLE 41: COW-CALF PRODUCTION COSTS FOR THE UNITED STATES AND WESTERN STATES, 1995

	United States	Western States
	------Dollars per Bred Cow--------	
Variable cash expenses[1]	321.82	363.88
General farm overhead	38.56	43.94
Taxes and insurance	15.96	20.77
Capital replacement	84.89	82.08
Operating capital	13.49	15.26
Other nonland capital	37.59	34.17
Land	0.04	0.03
Unpaid labor	92.42	79.26
Total	604.77	639.39

SOURCE: USDA, Economic Research Service.
1. Variable cash expenses include feeder cattle, feed costs (grain, protein supplements, by-products, harvested forages, and pasture), and other costs (including veterinary and medicine, livestock hauling, marketing, custom feed mixing, fuel, machinery and building repairs, and hired labor).

Private Land Acquisitions and Easements. No acquisition of private land or easements would take place under the existing plan.

Property Damage by Bison. Property damage occurs every year, and was especially evident during the winter of 1996–97 because of the large number of bison that moved outside Yellowstone National Park. There were at least four incidents of horses being gored in the winter of 1996–97, an event that rarely occurs. Under alternative 1, damage caused by bison could be expected to continue, with the number of incidents depending largely on the number of bison outside the park.

Perception of Risk of Transmission. Alternative 1 would reduce the perception of risk of transmission by monitoring the movement of bison, aggressively maintaining time and spatial separation between bison and domestic livestock, preventing bison from using private lands, selectively removing animals that test positive for brucellosis, and restricting bison distribution to public lands and situations in which brucellosis transmission from bison to cattle would be very unlikely. When a safe vaccine was developed, bison in the west boundary areas would be vaccinated for brucellosis. To date, this alternative has protected Montana's brucellosis class-free status, has avoided sanctions from other state animal health authorities, and has protected a viable population of Yellowstone National Park bison.

Cumulative Impacts

There would be no additional sources of impact.

Conclusion

Under alternative 1, direct impacts on livestock would be generally minor. Testing of most herds in West Yellowstone and vaccination of female calves would continue, but these costs would be a small portion of total production costs in the long term. However, producers who suffer property damage by bison might be moderately affected, or in some instances even more greatly affected, even though incidents are not common. Thus, while impacts overall would be relatively minor, individual ranchers could experience moderate to major adverse impacts due to bison.

Alternative 1 would provide sufficient control to prevent brucellosis transmission from bison to cattle. Infrequently, circumstances might occur in which brucellosis transmission from bison to cattle might occur. Protection from the risk of transmission of the disease would be premised upon all management actions being taken which prevent exposure of the disease to Montana livestock. Testing of contact livestock herds might be appropriate. However, it would be unreasonable for regulatory officials to impose general testing requirements on Montana cattle unless brucellosis was discovered in a contact herd. Unless sanctions were imposed due to disease-exposed bison being present at certain times and locations in Montana, the indirect economic effects on Montana's livestock industry would be negligible.

IMPACTS OF ALTERNATIVE 2

Analysis

Brucellosis Testing and Vaccinating. The interim plan would continue until cattle were

removed from the proposed SMAs through changes in grazing allotments, acquisition of private land, and/or conversion of operations to steer or spayed heifer production. Therefore, vaccination and testing practices as described under alternative 1 would also continue until susceptible cattle were no longer present. Thereafter, if any cattle remained in the SMAs, they would be part of steer or spayed heifer operations. However, producers on the boundaries of the SMAs would probably feel compelled to continue vaccinating female calves if they were already doing so, and producers with herds from Idaho that graze near the West Yellowstone SMA would probably be required to submit to testing, even though containment of bison within SMA boundaries would be strictly enforced. Thus, while testing and vaccinating would no longer occur in the SMAs, these practices would likely continue in neighboring areas if already taking place. If these producers near the SMAs had not been testing or vaccinating their cattle, the impact of now doing so would be minor. The impact for these producers would be minor. As described under alternative 1, vaccination and testing costs would be a small fraction of total production costs in the long term.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. Cow-calf operations near Yellowstone National Park represent the predominant type of cattle enterprise in Montana. Less common are steer or heifer feeding operations, in which the cattle are usually bought in the spring, vaccinated, and placed on rangeland grass throughout the summer. When they are returned to feedlots for fattening in the fall or winter, ownership can either be retained or the cattle can be sold to the feedlot operators. Feeding operations tend to be less economically predictable than cow-calf operations, with greater fluctuations in the cash flow cycle; more money could be made or lost in a shorter time period.

One aim of this alternative would be to remove susceptible cattle in areas where the bison would be allowed to roam, by replacing cow-calf operations with steer or spayed heifer enterprises. As indicated by the Montana Department of Livestock, the variables involved in making such a conversion would be too numerous to realistically estimate representative conversion costs. Structures and equipment, as well as managerial expertise, might need to be modified. Probably more significant than the capital and operational costs would be implicit changes in producers' objectives and their acceptance of greater market uncertainty. On the positive side, calf-related costs, including vaccination, would no longer be incurred.

Even with governmental incentives, most producers would likely balk at making the conversion, in essence, to a new type of livelihood within the livestock industry. Although their cattle would no longer be susceptible to brucellosis, it would be questionable whether this benefit would adequately justify for many producers the monetary and nonmonetary costs that conversion would entail. The amount of compensation that would be required by producers to convert from cow-calf operations could range widely, since each producer would differ in his perception of risks posed by bison and the personal satisfaction gained from raising calves. Some producers might be willing to convert at reasonable cost to the public, but others could be expected to refuse all feasible offers.

Without information on conversion costs or compensation amounts, estimates of conversion impacts for affected producers would be speculative. Clearly, it would be a voluntary decision, and, therefore, producers would only agree to conversion of their operations if they found the level of compensation acceptable. If conversion occurred, there would be an impact in terms of the livestock products produced, and compensation would result in producers' welfare, from each one's own perspective, at least being maintained.

Gallatin National Forest Grazing Allotments. Efforts would be made to modify grazing allotments under alternative 2. A total of about 926 cow-calf pairs, 434 pairs on six allotments to the north and 492 pairs on six allotments to the west, would be directly affected by this

alternative. These cattle numbers do not include 191 cow-calf pairs to the north and 2 to the west that would be grazed on adjacent private lands that are included in the allotments (see tables 17 and 18). In the West Yellowstone area, the Basin, South Fork, Sulphur Springs, and Watkins Creek allotments would be affected, in addition to the Horse Butte and Wapiti allotments found within the alternative 1 SMA.

Closure or modification of grazing allotments would result in negligible foregone income for the U.S. Forest Service. Current fees are $1.35 per AUM (animal unit month), while the market value of grazing land is much higher, averaging $11.80 in Montana in 1996 (Montana Agricultural Statistics Service, pers. comm. 1997). In addition to the fee paid by grazing permittees, the cost of grazing animals on allotments would include expenses for fence construction and maintenance, water developments, nutritional supplements, and animal management requirements such as herding and riding. Producers that needed to relocate their herds because of the closure of allotments would find it difficult to acquire other public grazing opportunities, and could experience moderate to major adverse impacts in shifting to privately owned land (U.S. Forest Service, pers. comm.). From a regional perspective, impacts would be minor, in that these herds represent less than 2% of all cattle and calves in Gallatin and Park Counties.

Private Land Acquisitions and Easements. Risk of brucellosis transmission to cattle could be reduced under this alternative by the acquisition or easement of private land. Cow-calf pairs potentially affected currently number about 100 in the Gardiner area. In the West Yellowstone area, about 215 cow-calf pairs that graze in the Horse Butte area could be affected. Purchase or easement costs have not been considered for private holdings in the Denny Creek/South Fork area on which about 585 cow-calf pairs are grazed.

Property Damage by Bison. Before susceptible cattle were removed from the areas designated to become SMAs, incidents of damage by bison would be expected to continue at about the same rate as under alternative 1. Following the changes proposed in alternative 2, there could still be occasional incidents of damage for producers that converted to steer or spayed heifer enterprises, but few of these operations would be expected. Therefore, alternative 2 should result in fewer occasions of damage to property or harm to livestock.

Perception of Risk of Transmission. This alternative would reduce the perception of risk of transmission by monitoring the movement of bison, restricting bison distribution until all susceptible livestock was removed from private and public lands within the SMAs, and removing bison from private lands in response to landowner complaints. This alternative would not eliminate the perception of risk of brucellosis transmission because it would include SMAs. The greatest potential for bison movements beyond the boundaries of the SMAs prior to removal would occur in this alternative. This would result in increased scrutiny of Montana's livestock industry by regulatory officials in other states.

Cumulative Impacts

There would be no additional sources of impact.

Conclusion

Once the SMAs, characterized by minimal bison management, have been established under alternative 2, testing and vaccinating would no longer be necessary in these areas. Producers near the boundaries of the SMAs would probably vaccinate female calves, and, in the West Yellowstone area, testing would continue. Thus, these safeguards would likely be maintained in areas bordering the SMAs, even though the boundaries would be strictly maintained. Continued testing and vaccinating by producers bordering the SMAs would have no impact on their operations. For producers newly testing or vaccinating, the impact would be minor since the costs per animal would be small in the long term, as described under alternative 1.

Substantial changes could occur for producers in the areas of the proposed SMAs, with the modification of grazing allotments, purchase or easement of private property, and possible conversion of operations. Public funds would be required for compensation of producers who agreed to convert from cow-calf to steer or spayed heifer operations, and for acquisition or easement of private lands. Damage by bison would decline.

Modification of grazing allotments would have moderate to major adverse impacts on the owners of displaced herds. They would probably need to acquire grazing rights on private property outside the SMAs, given that public grazing allotments in the region would be fully utilized. Although producers on private lands in the SMAs would receive payments, either for easement or selling of their property or as compensation for converting their operations to nonbreeding stock, such changes would also represent moderate to major impacts. The welfare of these producers might remain the same, or even be improved, but the location or composition of their herds would change. Impacts would not be major in terms of net monetary gains or losses for the affected producers, but their operations would be greatly altered.

While alternative 2 would provide control measures to prevent brucellosis transmission from bison to cattle, this alternative would have the greatest potential to change livestock operations in the vicinity of Yellowstone National Park. It would also provide for the largest number and broadest distribution of bison. This alternative would result in the greatest potential for regulatory officials to impose general testing requirements on Montana cattle because of their perception of risk. The indirect economic effects on Montana's livestock industry would be expected to be minor. If regulatory officials imposed general testing requirements, the effects would be moderate to major.

IMPACTS OF ALTERNATIVE 3

Analysis

Brucellosis Testing and Vaccinating. In the short term, testing and vaccinating could be expected to continue under this alternative as under the interim plan (alternative 1). In the long term, changes described under alternative 2 — conversion of cow-calf operations to steer or spayed heifer enterprises, modification or closure of grazing allotments, and acquisition or easement of private lands — would reduce the need for testing and vaccinating, but within smaller SMAs (although testing and vaccinating might still be necessary in the western SMA, where land acquisition/easement and herd conversion would be only options). Whereas approximately 2,019 cow-calf pairs were found within the areas designated to be SMAs under alternative 2, alternative 3 areas would contain about 895 cow-calf pairs (see alternative 3 map). There would be no impact on producers already testing and vaccinating their herds. For producers newly testing or vaccinating, the impact would be minor at the relatively small long-term cost per animal already described.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. The impact would be the same as for alternative 2, but the more restricted SMAs would mean fewer cow-calf operators would need to consider conversion. In the West Yellowstone area of the western SMA in particular, hunting would be expected to greatly limit bison numbers. Any producers who chose to convert their operations would require compensation, as described under alternative 2.

Gallatin National Forest Grazing Allotments. The impact would be similar to that of alternative 2, but on a smaller scale. Only about 86 cow-calf pairs, on the Green Lake, Park and Sentinel Butte allotments, could be affected in the Reese Creek area. About 364 pairs, on the Horse Butte and Wapiti allotments, could be affected in the West Yellowstone area if bison numbers warranted allotment modifications.

Private Land Acquisitions and Easements. Alternative 3 would include the acquisition or

easement of less winter range than alternative 2. Only about 100 cow-calf pairs would be affected in the Reese Creek area. Purchase or easement of private land in the West Yellowstone area of the western SMA would be an option under this alternative, and would affect about 215 cow-calf pairs.

Property Damage by Bison. In the short term, incidents of property damage under alternative 3 would occur as in alternative 1. In the long term, the removal of susceptible herds in the SMAs would result in a decrease in incidents.

Perception of Risk of Transmission. This alternative would reduce the perception of risk of transmission with actions similar to alternative 1 during the first phase and during the second phase by monitoring the movement of bison, maintaining time and spatial separation between bison and domestic livestock, removing bison that moved onto private lands, restricting bison distribution to public lands and situations in which brucellosis transmission from bison to cattle was unlikely, and eventually removing all susceptible livestock from private and public lands within the SMAs. This alternative would not eliminate the perception of risk of brucellosis transmission because it includes SMAs and quarantine facilities. Movements of bison beyond the boundaries of the SMAs might occur during some winters, but the alternative would specify removal of bison when this occurred. The potential for bison movements beyond the boundaries of the SMAs would be greater than for alternative 1 and less than alternative 2.

Cumulative Impacts

There would be no additional sources of impact.

Conclusion

In the long term, livestock producers would have impacts under alternative 3 similar to those described under alternative 2, but on a smaller scale. Privately and publicly grazed cattle that could be directly affected under this alternative number about 895 cow-calf pairs, compared to about 2,019 for alternative 2. In terms of major long-term impacts, such as possible conversion from cow-calf to steer or spayed heifer production, modification of grazing allotments, and private land acquisitions or easements, the number of livestock directly affected could be smaller still because these changes are considered only possible options for the West Yellowstone area under alternative 3. As in alternative 2, impacts would be major not in terms of net monetary benefits or costs, but as locational or operational changes for affected producers.

Alternative 3 would provide control measures to prevent brucellosis transmission from bison to cattle and has the potential for modifying changing livestock operations in the vicinity of Yellowstone National Park similar to that described for alternative 2. It would also provide for similar numbers and distribution of bison, but would include more actions to control bison. This alternative would result in a greater potential for regulatory officials to impose general testing requirements on Montana cattle than in alternative 1 but less than alternative 2. The indirect economic effects of Montana's livestock industry would be expected to be minor. If regulatory officials imposed testing requirements, the effects would be moderate to major.

IMPACTS OF ALTERNATIVE 4

Analysis

Brucellosis Testing and Vaccinating. Impacts of brucellosis testing and vaccinating would be the same as described for alternative 1.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. No impacts would be expected as conversion from cow-calf operations to steer or spayed heifer enterprises would not be part of alternative 4.

Gallatin National Forest Grazing Allotments. Grazing allotments would remain unchanged under this alternative.

Private Land Acquisitions and Easements. No acquisition of private land or easements would take place under this alternative.

Property Damage by Bison. Incidents of property damage would be similar to alternative 1, but hunting would help control bison numbers in the West Yellowstone area under alternative 4.

Perception of Risk of Transmission. Similar to alternative 1, circumstances in which brucellosis transmission from bison to cattle might occur as infrequent events under alternative 4.

Cumulative Impacts

There would be no additional sources of impact.

Conclusion

Impacts on cattle producers under alternative 4 would be the same as under alternative 1, namely, minor overall with continuation of vaccination and testing costs and the occasional threat of bison damage. Hunting could provide an additional source of income for private holdings, as described in "Impacts on Socioeconomics."

IMPACTS OF ALTERNATIVE 5

Analysis

Brucellosis Testing and Vaccinating. Under alternative 5, no bison would be allowed outside Yellowstone National Park. However, cattle producers in the vicinity of the park might continue to vaccinate their herds, particularly in the short term, if they were not completely confident that all bison would be confined within park boundaries. In the long term, with vaccination of Yellowstone bison, cattle vaccinations might become less important to the producers, but could still be continued. Modification of testing practices in the West Yellowstone area would depend on changes in Idaho's agreement with Montana. Given that testing and vaccinating costs are relatively small, relaxation of these practices would only have a minor beneficial impact.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. No impacts would be expected as conversion from cow-calf operations to steer or spayed heifer enterprises would not be part of this alternative.

Gallatin National Forest Grazing Allotments. Grazing allotments would remain unchanged.

Private Land Acquisitions and Easements. No acquisition of private land or easements would be expected.

Property Damage by Bison. Incidents of private property damage would be unlikely to occur because the bison would not be allowed outside Yellowstone National Park.

Perception of Risk of Transmission. This alternative would reduce the perception of risk of transmission by limiting the distribution of bison to Yellowstone National Park and aggressively reducing the incidence of brucellosis infection in this herd. It was estimated that this alternative would eliminate brucellosis from the Yellowstone bison herd within five years after implementation.

Cumulative Impacts

No additional sources of impact would exist.

Conclusion

Restriction of bison to the park would lessen concerns over brucellosis transmission, even if testing and vaccinating of domestic livestock were to continue as at present. Private grazing resources might increase in value due to reduced risks of disease spread and damage by bison, although a small percentage of elk would continue to harbor the bacteria. Thus, the overall impact on affected livestock producers would be moderately beneficial.

Protection of Montana's brucellosis class-free status would be the greatest under alternative 5, and threats of sanctions against Montana livestock by other state animal health authorities would be the least under this alternative.

Implementation of alternative 5 would not negatively affect Montana's livestock industry.

IMPACTS OF ALTERNATIVE 6

Analysis

Brucellosis Testing and Vaccinating. Consequences of this alternative with respect to testing and vaccinating would be the same as for alternative 1 during the first years of vaccination of the bison herd. Once capture, test, and slaughter of bison were undertaken, the consequences for livestock producers would be like those under alternative 5, although seronegative bison would be allowed on public land in the western SMA (see alternative 6 map). Cattle vaccination would probably continue, depending on producers' risk perceptions. Continued testing of herds in the West Yellowstone area would depend on Idaho's agreement with Montana.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. No impacts would be expected as conversion from cow-calf operations to steer or spayed heifer enterprises would not be part of this alternative.

Gallatin National Forest Grazing Allotments. Grazing allotments would remain unchanged.

Private Land Acquisitions and Easements. No acquisition of private land or easements would take place under this alternative.

Property Damage by Bison. Incidents of property damage would be similar to alternative 1.

Perception of Risk of Transmission. This alternative would reduce the perception of risk of transmission by monitoring the movement of bison, aggressively maintaining time and spatial separation between bison and domestic livestock, preventing bison from using private lands, restricting bison distribution to public lands and situations in which brucellosis transmission from bison to cattle would be very unlikely, and aggressively reducing the incidence of brucellosis infection in this bison herd, initially with vaccination and subsequently through test and removal. This alternative would not eliminate the perception of risk of brucellosis transmission because it would include SMAs.

Cumulative Impacts

No additional sources of impact exist.

Conclusion

In the long term, impacts would be generally the same under this alternative as under alternative 5. Benefits for livestock producers from the control of brucellosis in Yellowstone would be moderate overall.

Alternative 6 would have no adverse effects on Montana's livestock industry.

IMPACTS OF ALTERNATIVE 7: PREFERRED ALTERNATIVE

Analysis

The SMAs identified for phase 1 of the preferred alternative would be the same as those under the interim plan (alternative 1), and impacts on livestock producers under the first phase would be the same as those described for alternative 1. If additional lands were acquired north of the park (the Reese Creek SMA) in phase 2 of alternative 7, SMA boundaries would match those described in alternative 3, and impacts on livestock would be similar to those discussed under that alternative, with the exception that no changes in livestock operations to remove breeding stock would be anticipated.

Brucellosis Testing and Vaccinating. Under both the short- and long-term phases of the preferred alternative, Montana would encourage

producers that graze herds in the vicinity of Yellowstone National Park to vaccinate their calves with the RB51 vaccine. Since all producers currently vaccinate calves voluntarily, this requirement would have no impact. As estimated under alternative 1, producers in the region have herds totaling about 2,019 cow-calf pairs, and with vaccination costs of $5 to $10 per calf, spend annually between $5,050 and $10,100. As shown in the discussion of alternative 1, costs of vaccination would be less than 2% of all production costs.

Also as described in alternative 1, an estimated 80% to 90% of the affected herds in the West Yellowstone area have their home base in Idaho, and by agreement between the two states, would be tested for brucellosis before they enter Montana and again before they reenter Idaho. It would be expected that this agreement would continue under both phases of this alternative. Therefore, there would be no impact or change from existing testing practices. Costs of testing were estimated under alternative 1 as ranging between $7.50 and $15 per head. As shown under alternative 1, with an estimated 1,294 cow-calf pairs in the West Yellowstone area, testing costs for cattle from Idaho were estimated to total between $15,528 and $34,938.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. No conversion of livestock operations is expected under this alternative.

Gallatin National Forest Grazing Allotments. No changes in grazing allotments would occur in the West Yellowstone area. The status of three allotments to the north of Yellowstone National Park (Green Lake, Park, and Sentinel Butte), on which about 86 cow-calf pairs are grazed, could be affected in the long term. Approximately 130 cow-calf pairs are grazed on adjacent private land, as part of these allotments. Elimination of the three grazing allotments would adversely affect the permittees, since other public grazing land in the region would probably be unavailable (U.S. Forest Service, pers. comm.). Impacts would be moderate to major for the individuals affected, but negligible on a regional scale.

Private Land Acquisitions and Easements. No acquisition of private land or easements is anticipated in the West Yellowstone area. Cow-calf pairs potentially affected currently number about 100 in the Gardiner area. Purchase or easement costs have not been estimated for private holdings in the Denny Creek/South Fork area on which about 585 cow-calf pairs are grazed. Private lands north of the park boundary at Reese Creek and west of the Yellowstone River are the only private holdings that could potentially be acquired for use in the long-term management in this alternative.

Property Damage by Bison. As explained in the "Affected Environment" and in the discussion of impacts in alternative 1, livestock, structures, and humans are at risk when bison leave the park. Under this alternative, no bison would be allowed beyond SMA boundaries. However, property damage by bison could be expected to continue as in the past for producers and property owners within the SMA boundaries under phase 1. In particular, producers in the Horse Butte area of West Yellowstone might be affected. With the reduction in the bison population due to the severe 1996–97 winter, the number of incidents would likely be low for the immediate future.

Indirect Impacts. Under the preferred alternative, short-term impacts would be similar to alternative 1, and long-term impacts would be similar to alternative 3.

Cumulative Impacts

No additional sources of impact would exist.

Conclusion

Under the first phase of the preferred alternative, brucellosis testing and vaccinating of cattle in the vicinity of Yellowstone National Park would continue as under the interim plan, and no changes in or removal of livestock operations would occur. Damage caused by bison would likely continue, with the frequency of incidents dependent on the number of bison migrating

outside the park. In the long term, modification or closure of the allotments and purchase or easement of the private property would eliminate any risk of disease transmission from bison in the newly created Reese Creek SMA. These have a combined cow-calf population of 316 pairs. This would have moderate to major impacts on three public grazing allotments, one large private holding, and several smaller holdings north of the park . The livestock producers that use these grazing resources might need to modify their operations or relocate to other areas outside the SMA. Public funds equal to the fair market price would be required to acquire the private land.

In the West Yellowstone area, temporal separation and capture, test and slaughter operations would minimize the risk of brucellosis transmission to affected herds; therefore, the long-term impact on operators in the western SMA would be minor to moderate, compared to major relocational impacts to affected operations in the Reese Creek/Gardiner Valley area.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

In the livestock industry, there would be no irreversible or irretrievable commitments of resources under the alternatives. Even in those instances in which public grazing allotments might be closed or modified and the title or use of private land acquired within SMAs, such decisions could be reversed if they were found over time to not result in expected societal benefits. Structures and other improvements might have to be replaced, but the basic resource — land for grazing — would remain.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

In none of the alternatives would long-term resource productivity be sacrificed because of short-term goals.

UNAVOIDABLE ADVERSE IMPACTS

Livestock producers in the vicinity of the park must be on constant guard against transmission of the disease to their herds because of the presence of brucellosis in bison of Yellowstone National Park and their off-park migration. Regular vaccination and, for herds from Idaho, testing of cattle would be two precautionary measures taken. Although their cost is relatively minor, these activities represent adverse impacts of raising cattle near exposed bison. The risk of bison damaging stock or property would be another adverse consequence of ranching near Yellowstone National Park. As long as the bison carried brucellosis and left the park, these types of impacts would continue, although they might be minimized through modification of grazing allotments, acquisition of private land, and other actions included in the various alternatives. Operations affected by the modification of grazing allotments would be unavoidably affected. Other changes in resource use — from selling or easement of private land, to conversion of cow-calf operations to nonbreeding stock enterprises — would be voluntary and therefore avoidable.

SUMMARY OF REGULATIONS AND POLICIES

National Environmental Policy Act regulations require analysis of social and economic impacts resulting from proposed major federal actions in an environmental impact statement. In addition, Executive Order 12898, dated February 11, 1994, on "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires federal agencies to assess the impact of actions on cultural minority and low-income communities. Although there are no specific regulations requiring protection of social values, impacts on social values are considered an important part of the federal planning processes. The assessment of the economic effects of the proposed action follow the general principles outlined in the U.S. Water Resources Council's *Principles and Standards for Planning Water and Related Land Resources* (Water Resources Council, U.S. Department of Interior 1983).

METHODOLOGIES FOR ANALYZING IMPACTS

No original data were collected for this assessment; thus, the impact analysis relied on the methods and findings in the existing social science literature (e.g., Kellert 1976). Accordingly, there is considerable uncertainty in many of the estimates described here — as sometimes reflected in a wide range of reported possible values for some specific impacts. Economic parameters related to the regional economy were generally derived from existing studies using regional economic input-output or economic base type methodologies. Economic parameters related to nonmarket values were derived from previous studies that largely used contingent valuation or travel cost model methodologies (general methods are described in Braden and Kolstad 1991; Ward and Duffield 1992). The use of benefit studies for one resource to estimate values for another resource is called the benefits transfer method (Walsh and McKean 1993). This method is used to estimate nonmarket values for bison. Real discount rates of 7% were used to compute annual and present values following Office of Management and Budget (1992) guidelines.

Existing literature related to social effects and attitudes relied on standard methods in sociology and social psychology, including survey research, focus groups, key informant interviews, and various statistical techniques such as multiple regression analysis and cluster analysis. Some of the assessments reported below were based on Kellert (1976). A case in point is the history of the Wood Buffalo National Park management proposals and the strong negative public response (by the Canadian people as a whole) to an alternative that relied heavily on the slaughter of bison. (Depopulation to the degree proposed in the Wood Buffalo herd is not a part of any alternative analyzed in the environmental impact statement. It is cited here simply to show public reaction to bison slaughter.)

A draft report prepared by Ravandal (1997) also provides some information on social values of particular groups concerned about the bison management issue. This report was also used for analysis of this impact topic.

IMPACTS COMMON TO ALL ALTERNATIVES

The management of bison would involve killing through agency shooting, transport of sero-positive animals to slaughter, hunting, and other actions that some would find objectionable. People who do take offense might object for any number of reasons: that the killing of any animals is inappropriate, that human management of wildlife is not needed, or that bison do not need to be controlled to prevent brucellosis transmission from bison to cattle, for example. All alternatives would involve bison

management, and so each would have some potential for adverse public reaction that might result in the call for a tourism boycott, although the potential would likely vary among the alternatives. The potential for such a call, and the effectiveness of such a boycott are difficult to judge.

A tourism boycott organized in Alaska in the early 1990s in response to a state policy to reduce populations of another wildlife species, the grey wolf, was effective. In response to the boycott, then Governor Hickle called off the wolf control program. It was estimated that, had the boycott continued, the impact on the Alaska tourism economy would have been major and adverse, on the order of approximately $85 million in lost business or about 15% of the dollar revenues of this sector in Alaska (Dindinger, undated).

Conversely, the impact of a boycott organized in response to bison hunting in Yellowstone in 1988-89 resulted in no lost tourism in Montana, and nonresident tourism increased during this period (Institute for Tourism and Recreation Research, pers. comm.). Peacock (1997) notes that the Fund for Animals purchased a full-page ad in USA Today in early winter 1997 calling for a boycott of Montana tourism in response to the slaughter of bison under the interim plan. Although the response to this call has not been measured, Montana believes its impact was negligible or minor. This is based on the relative ratio between the amount of inquires Travel Montana (Montana Department of Commerce) received (400,000) and those inquiries related to bison (140 in Montana fiscal year 1997). These conflicting data mean the effectiveness or economic impact of a boycott is unknown, and could be negligible, major, or somewhere in between. The probability of such a boycott being initiated is also unknown, but likely varies between alternatives with the number of bison killed and the visibility and exposure of the control methods used.

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

The economies of Gallatin and Park Counties have benefited in recent years from growth tied to the area's high quality wildlife and wildland resources. Wildlife, in turn, have benefited from the large amount of public land in the counties, along with the open space provided by large tracts of privately held agricultural land. To the extent that the alternatives could augment wildlife resources (wildlife populations and habitat), this would be a benefit to the existing trend. Conversely, to the extent that the alternatives could diminish wildlife resources, the negative impacts are somewhat offset by the positive regional economic trend related to wildlife and the natural environment.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Regional Economy. Implementing alternative 1 would continue existing economic trends as described in the "Socioeconomics" section of the "Affected Environment." Alternative 1, in allowing livestock production to the north and west of Yellowstone National Park to continue, would likewise enable its contributions in the economies of Gallatin and Park Counties to continue. Producers grazing herds in the affected areas would maintain their current relatively minor role in the region's beef cattle industry and in the regional economy as a whole.

Minority and Low-Income Populations. Fifty-eight bison (56% of the average 103 bison expected to be slaughtered or shot each year under alternative 1) would be donated to Indian tribes and charitable organizations per year. The value of the donated carcasses would be equivalent to the value received in auction ($337/animal). The total annual value of the 58 donated carcasses would be $19,546. Charities would receive a net benefit of about $2,545, and Native Americans would receive about $17,000 worth of bison. Other members of society might

also value the idea that bison were being distributed for food to minority and low-income populations.

Social Values. The scale of impacts on social values of any of the alternatives would depend on the intensity of impact on a representative individual of some population and on the size of that population. In general, this analysis would be hampered by the absence of any general population surveys concerning the bison-brucellosis issue. Accordingly, the analysis of impacts on social values would be largely qualitative, judgmental, and imprecise.

Based on a review of the written comments to the environmental assessment of the *Interim Bison Management Plan* (NPS and State of Montana 1995), the feature of the proposed plans about which commenters felt most strongly was bison slaughter. Strong statements were also made about the need to protect ranchers from the impacts of brucellosis. These were respectively moralistic-humanitarian versus utilitarian attitudes (see table 26). Based on analysis of population surveys related to a similar issue (wolf reintroduction; USFWS 1994; Duffield 1992), it appeared that utilitarian attitudes toward that issue led to only a minority of the U.S. population opposing wolf recovery. Ecologistic and naturalistic attitudes led a large majority to favor wolf recovery nationally. However, opinions were about evenly divided in the three states of Idaho, Montana, and Wyoming, as well as in the counties comprising the greater Yellowstone ecosystem (Duffield, Neher, and Patterson 1993). The bison-brucellosis issue would not be identical to the wolf recovery issue, but there would be similarities. Similarities would be that both actions centered on management of high profile wildlife species in a popular national park, the primary conflicts would be with the livestock industry, and both actions would involve controversial management removals of the key species. While the wolf policy discussions in Yellowstone were centered on endangered species issues, in the Minnesota and Canadian settings, the wolf policy would be primarily about the management of existing populations. Clear differences would be that the wolf policy concerns focused on the presence/absence of an endangered species. Bison are not an endangered species, and all alternatives would maintain the ecological integrity of the Yellowstone National Park herd. Also, livestock disease control and public hunting are not issues related to the wolf policy. It seems likely that among those who are keenly interested, more people viewed the bison issue from a moralistic-humanitarian perspective than from a utilitarian perspective. This has not been definitively measured. However, a case in point is the history of the Wood Buffalo National Park management proposals (see discussion under "Methodologies for Analyzing Impacts" section). Based on this analysis, the primary adverse impact on social values of any aspect of the alternatives would likely be the extent to which the alternative relied on slaughter. A positive impact would be associated with alternatives that maintained the livestock industry and cattle ranching as a way of life.

A continuation of alternative 1 would entail a continued reliance on slaughter of bison at the average annual level of 103 animals per year and would likely be a minor to moderate adverse impact. This would be at the middle level of slaughter for all alternatives, and, as in all alternatives, would be based on a model that predicted average numbers of migrating bison. However, bison leave the park in response to many factors, among them stochastic events such as severe winters. This was true in the winter of 1996–97, when more than 1,000 bison left the park and were captured and slaughtered according to the provisions of the interim operating plan. Based on the public reaction to this level of removal, the overall impact on social values of this alternative would likely be minor to moderately adverse. The majority of the U.S. population's values concerning humanitarian and moral treatment of animals would likely be negatively affected. No animals would be being quarantined, so Native Americans would only benefit via a share of slaughtered animals, which is a negligible benefit in the context of overall food needs for tribes.

Some tribes would view the capture and test operations as being in conflict with their cultural beliefs, i.e., that bison would be fully protected and respected. Impacts on social values associated with local ranching lifestyles would be negligible; current management operations and practices would continue.

Nonmarket Values. Impacts on benefits that visitors and others derive from Yellowstone National Park and the greater Yellowstone ecosystem would result from changes in park visitation levels (both summer and winter), wildlife viewing opportunities, and existence values associated with population levels and distribution. Accordingly, impacts on nonmarket values for all alternatives would be based largely on the impacts previously described in the "Impacts on Recreation" section. Most of these impacts would in turn be driven by changes in bison populations and distribution.

Given the range of the bison population in this alternative and the accuracy of the benefits transfer method, it would be difficult to quantify with great certainty the impacts on the nonmarket viewing and existence values. There are no impacts of this alternative on winter recreation or hunting.

Conclusion

Alternative 1 would have a negligible impact on the regional economy or on nonmarket benefit accounting, compared to the status quo in 1996–97. There would be a minor to moderate adverse impact (due to the level of slaughter in this alternative) on social values associated with humanitarian and moral treatment of animals.

IMPACTS OF ALTERNATIVE 2

Analysis

Regional Economy. Because alternative 2 would lead to the largest bison spatial distributions of all alternatives, it would also afford the greatest bison viewing opportunities of all alternatives. Increasing visitor expenditures in the Yellowstone area by visitors drawn to the area for wildlife viewing might be less than or equal to the estimated positive impacts associated with wolf recovery, estimated at $20 million in annual visitor expenditures (Duffield 1991a). The closure of approximately 60 miles of previously groomed roads and trails within Yellowstone National Park would have a moderate to major adverse impact on the distribution of oversnow travel within the park. Approximately 47% of winter visitation to the park could enter through the west entrance, and the winter economy of West Yellowstone, Montana, would be centered around tourists who come to recreate in the park as well as on public lands outside the park.

Although current winter use patterns for roads and trails would suggest that a closure of the road from West Yellowstone to Madison Junction would have a devastating impact on West Yellowstone's winter economy, available data on winter use and expenditures in West Yellowstone would provide a less drastic picture. In the winter of 1995–96, the shutdown of the federal government caused the national park system to be closed for parts of November, December, and January. In fact, a combination of late snow and the extended park shutdown caused the road from West Yellowstone into the park to be closed for essentially all of December 1995. Despite a complete lack of access to the park from the west entrance by oversnow vehicles, West Yellowstone resort tax collections only dipped 6.5% from their all time high mark for the month of December, set the previous year in 1994. Interestingly, West Yellowstone resort tax receipts for December 1996 were 2% lower than December 1995 receipts (the month when the park was closed). It therefore appears that other factors as noted above could have as significant an effect on West Yellowstone visitation as would access to the park through the west entrance.

Analysis of in-park and national forest winter recreation statistics for the 1995–96 winter (see table 15) shows that while the Yellowstone National Park winter use level dropped by

14.5% (approximately 20,000 visits) from the previous year, snowmobile use in the Hebgen Lake District of the Gallatin National Forest increased by 22.3% (approximately 20,000 visits) from the previous year. In a 1996 letter to the Interagency Winter Use Planning Group, the executive director of the West Yellowstone Chamber of Commerce acknowledged the importance of the hundreds of miles of groomed trails outside the park: "Each year thousands of snowmobile enthusiasts flock to our area to enjoy not only Yellowstone National Park, which may be the highlight of their visit, but proves to be the place where they spend the least amount of time, . . . but also the extensive trail system which extends from West Yellowstone throughout the Gallatin and Targhee National Forests, into the Bridger-Teton, and beyond." The combination of West Yellowstone resort tax data and park and national forest visitation data suggests that, at least for the short-term closure of park roads seen in 1995–96, the negative economic impact on the local economy of West Yellowstone would be almost entirely mitigated by visitors shifting their recreation from park areas to national forest areas outside the park.

In a study examining the economic impacts of the 1995–96 shutdown (Neher, Robison, and Duffield 1997), it was estimated that each winter visit through the west entrance to the park would account for approximately $153 in tourist expenditures in West Yellowstone.

Table 42 shows the derivation of low- and high-end estimates of tourist expenditure losses in West Yellowstone due to the road closure. For a low end, it was estimated, based on Neher, Robison, and Duffield (1997), that a full closure of the west entrance would translate into a 6.5% decrease in tourist expenditures in West Yellowstone. While this relationship was based on observed recent data, it was used as a low-end estimate in recognition that it was a short-term disruption that happened without much warning. Given sufficient advance notice of road closures in the park, more nonlocal tourists might visit other areas rather than West Yellowstone.

A high-end estimate of losses to the West Yellowstone economy is also presented in table 42. Various sources cite the number of miles of groomed roads and trails in the park at approximately 200 with an additional 200–400 miles of groomed trails outside the park but in the general vicinity of West Yellowstone. As a midpoint it is estimated that 40% of area groomed roads are inside the park. Therefore, a reduction in visitation to West Yellowstone would be proportional to the percentage of miles of groomed roads in the areas that were closed or not readily accessible from West Yellowstone (40%). Furthermore, it is estimated based on the experience of the 1995 shutdown that one-half of the visitation displaced by the elimination of 40% of groomed roads would move their activities exclusively to Gallatin National Forest rather than stop visiting the West Yellowstone area. Using these assumptions, closure of the road into the park from the west gate and other road closures in the park would result in a high-end estimated reduction of 20% of winter visitation to the West Yellowstone area or a loss of between 2,150 and 13,250 visits through the west entrance. There also would be a loss of between $656,000 and $2.0 million in winter expenditures in the town of West Yellowstone. This would represent between roughly 0.6% and 1.9% of total annual sales in West Yellowstone. The overall economy would be negligibly affected, but individual businesses specializing in winter activities could be more significantly affected.

The other economic area likely to be affected by the alternative 2 road closures would be Gardiner, Montana. Gardiner would not be as heavily affected by road closures as West Yellowstone because the proposed closures would only affect one access point to the park interior from Gardiner. Still open would be the road from Cooke City and groomed trails from Canyon and points beyond. Therefore, the loss estimates for West Yellowstone would likely significantly overstate the impacts of closures on the Gardiner area. In fact, it is even possible that Gardiner could benefit from additional visits from park visitors displaced from West

TABLE 42: ESTIMATED REDUCTION IN VISITATION AND TOURIST EXPENDITURES IN WEST YELLOWSTONE RESULTING FROM ALTERNATIVE 2 ROAD CLOSURES

STATISTIC	LOW ESTIMATE	HIGH ESTIMATE
Estimated west entrance winter visitation	66,000 [1]	66,000 [1]
Estimated West Yellowstone winter visitor expenditures	10,980,000 [2]	10,980,000 [2]
Estimated % reduction in West Yellowstone expenditures	6.5% [3]	20.0% [4]
Estimated reduction in expenditures	$656,000	$2,020,000
Estimated reduction as a % of annual sales	0.6% [5]	1.9%

1. Estimate based on December 1994–March 1995 west entrance visitation levels and an anticipated 100% decrease in west entrance visitation.
2. Based on an estimate of $153 of expenditure in West Yellowstone per west entrance visit and on 1994–95 winter visitation levels.
3. Based on West Yellowstone resort tax collection data and Neher, Robison, and Duffield, 1997.
4. Based on the ratio of in-park to total area groomed trails and an assumed 50% substitution factor of national forest recreation for closed park recreation.
5. Based on estimated 1994 total output for West Yellowstone of $108.7 million.

Yellowstone who base their visit out of Gardiner instead. Due to the uncertainty in the impacts on the Gardiner area, it is estimated that this area would see a minor negative to a minor positive impact from the road closures.

With respect to the livestock sector, in the long run if all cattle were removed from the SMA under alternative 2, any negative impact on the region would likely be countered by increased tourism and related revenues deriving from a minimal management strategy. These negative and positive impacts could be felt differently by members of local economies surrounding the park. The businesses and individuals experiencing positive economic impacts from increased tourism could be different from those experiencing negative impacts of reduced agricultural activity in the area. Some believe that agricultural operations and tourism activities would not be mutually exclusive and could have positive impacts on each industry.

The government sector would incur costs associated with the purchase of winter range. Although no appraisals have been conducted, it is estimated by the U.S. Forest Service that purchase of affected private lands, not including holdings in the Denny Creek/South Fork area, would require about $44.1 million. Easement costs were not estimated but would likely be less than outright purchase.

Minority and Low-Income Populations. No or very few bison carcasses would be donated to Native Americans or charitable organizations that provide food for the needy. This would be a negligible economic impact.

Social Values. Alternative 2 would have a minor adverse impact on social values favoring traditional ranching lifestyles in the areas immediately adjacent to the park. This would be negligible in the context of the Montana cattle industry. There would be no adverse impact on moral and humanitarian attitudes toward wildlife under this alternative, but rather a relative positive impact compared to the continued implementation of alternative 1.

However, some individual ranchers affected by changes in cattle operations might view this as a major impact on their lifestyles and values. Some tribes might view the management of bison in this alternative to be less severe compared to other alternatives. Some residents across the country might perceive an impact on cattle ranching while others might be supportive of the ability of bison to move more freely across the landscape.

Nonmarket Values. Alternative 2 would have a 14% increase in bison population relative to alternative 1 in 2006, and also have the largest proposed SMAs, which would lead to the largest

bison spatial distributions of all alternatives. This would be a moderate to major positive impact on bison existence values.

For example, a change in elk population in the Northern Yellowstone herd of 20% was found to have a value per person of $32.61 for park visitors (see table 27) and an aggregate value of about $73 million (Duffield 1989, 1991b). The change in elk populations was based on a 1989 proposal by the Montana Department of Fish, Wildlife and Parks (DFWP) to purchase 2,098 acres of cattle summer range to expand the winter range available to elk coming out of Yellowstone National Park. The timing of this particular proposal was following the severe winter of 1988–89 in which 4,400 to 5,500 elk died of winter kill — about 25% of the Northern Yellowstone herd. The DFWP proposal was part of a larger cooperative effort by the state, the U.S. Forest Service, and the Rocky Mountain Elk Foundation to add about 10,000 acres to this elk herd's winter range adjacent to and north of the park. In many ways the DFWP-Forest Service-Elk Foundation proposal parallels alternatives 2, 3, and 7 because management includes the potential for land purchase or easements from existing livestock use. The migration of bison out of Yellowstone, especially in severe winters such as 1996–97, parallels the migration of elk following the winter of 1988–89.

With respect to the Department of Fish, Wildlife and Parks' share, the net social benefits of that purchase greatly exceeded the opportunity cost of the property in its next best use (reflected in the purchase price of $1.5 million). Interestingly the purchase price was approximately five times as high as the price that could be supported by the net income from the property in its then current use (outfitting and livestock). Land prices in the Paradise Valley, then, as now, are primarily driven by residential-recreational values and are no longer agriculturally based.

Because there have been no estimates specific to Yellowstone bison of the values associated with increasing their winter range, it is necessary to provide a range of estimates from the literature. The per person estimate for elk (in table 27) provides one point of comparison. This estimate (which is in 1997 dollars) can be applied to the approximately 2 million summer adult visitors to Yellowstone yielding an aggregate estimate of the benefits associated with expanding bison winter range of about $67 million. If one actually tried to collect this amount of money using charitable contributions, previous studies would suggest the estimate would be calibrated to anywhere from $6.7 to $19.2 million (Duffield and Patterson 1991; Duffield, unpub. data). Another set of values that bracket the bison ranking in table 27 are the national values for grizzly bears ($15.22) at the upper end and for wolves at the lower end ($3.04). If these are conservatively applied to U.S. households (rather than adult populations) of about 75 million, the resulting value estimate is about $23 million to $326 million (including the effect of calibration for actual willingness to pay). This is a present value (one time contribution) that can be amortized at a 7% real interest rate to yield a range of $1.6 to $22.9 million per year.

One could also compute a range based on estimates for local state populations based on values for eagles and wolves. The conclusion is that the U.S. public and park visitors in particular might place a high dollar value on the benefits of expanding bison winter range near Yellowstone National Park. To narrow the considerable range in the estimates would require original data specific to the problem.

Overall, alternative 2 would have only a negligible to minor positive effect on bison populations compared to alternative 1 and accordingly only a negligible to minor positive effect on nonmarket bison viewing. Given the accuracy of the benefits transfer method, it would be difficult to quantify with great certainty the impacts on nonmarket bison viewing values.

There are no estimates available in the literature of the current value of winter visits to Yellowstone National Park for snowmobiling and other winter activities. One would expect these more specialized uses of the park to be

higher valued on average than spring-summer-fall visits, which are estimated to have a median value of $166 for regional and $700 per trip for out-of-region visitors. As noted above, there would be some uncertainty as to the extent to which ceasing to groom winter roads in the park would merely lead to substitution of trips to offpark sites (or the extent to which these offpark trips are of equal value). Using the range of reduction in winter recreation in the greater Yellowstone ecosystem associated with this alternative of 4,300 to 13,250 visits, the estimated median value of this loss would be $2.5 million to $7.6 million. Again, these would be current trip-based values and actual and stated willingness to pay might correspond one to one (Bishop and Heberlein 1979; Ward and Duffield 1992). The range of reductions in winter recreation would lead to moderate adverse impacts.

Conclusion

The impact on the regional economy of this alternative likely would either be negligible or a minor positive effect. The possible range in reductions in winter recreation use and the livestock industry would generally be offset by increases in wildlife viewing-related visitation. On the assumption that acquisition would occur, and from a social benefit-cost standpoint, there would be a considerable range in impacts ranging from moderate negative to major positive. There would be an overall negligible to minor impact on social values — for some this would be an adverse impact, for others a beneficial one. Some individual ranchers affected by this alternative might view this as a major adverse impact. Some residents across the country might be highly supportive of the actions in this alternative.

IMPACTS OF ALTERNATIVE 3

Analysis

Regional Economy. Bison populations under this alternative would be very similar to alternative 2, but bison would likely be less widely distributed outside the park boundaries under alternative 3. Therefore, the benefits associated with this alternative are anticipated to be slightly less than described for alternative 2.

This alternative would have an economic impact on the local economy through expenditures made by hunters during their stay in the hunting area. This alternative would also generate revenues for the state of Montana through collection of application fees and awarding 75 tag permits beginning in 2000 (see table 43). A few more permits, up to 85, might be issued by 2005. However, the positive effect of the increased revenues would be offset by corresponding increases in costs to administer the bison hunting season.

Table 43: Annual Economic Values and Expenditures Associated with Bison Hunting Opportunities in the Yellowstone Area under Alternative 3

	75 permits
Fees to Montana Department of Fish, Wildlife, and Parks[1]	$53,320
Hunter Expenditures[2]	$32,960
Net Economic Value[3]	$23,980

1. The applicant number, application fees, bison tag permits, and percent to residents and nonresidents were assumed to be the same as the 1996 Wyoming hunt (2,300 applicants, $5 nonrefundable application fee, $1,688 nonresident permit, $275 resident permit, and 80% of the permits reserved for state residents).
2. The average length of stay in the area was assumed to be 3 days per hunter: 2 days of hunting and 1 additional day in the area. Length of stay for a bison hunter was estimated at 3 days in the Jackson Bison Herd Draft Environmental Assessment (1994) based on communications with agency personnel. Average daily hunter expenditures are estimated to be $146.58. This number is based on elk hunters expenditures in Montana (Duffield 1988) and adjusted to 1996 price levels. Total hunter expenditures is (3 days)(75 hunters)($146.48/hunter day).
3. Net economic value was assumed to be $106.58 per day based on the net economic value reported for elk hunting (Duffield 1988) and adjusted to 1996 price levels.

It is clear from the sample of current hunts in the United States and current and past hunts in the Greater Yellowstone Area (see table 16) that the demand for bison hunting far exceeds the supply. A lottery for a limited number of permits to hunt the Yellowstone bison would receive a large number of applicants who would be willing to pay a substantial fee for the privilege to hunt a wild bison. The proposed bison hunt

north of Yellowstone National Park should be very similar in hunter interest and willingness-to-pay to the 1996 hunt held in Wyoming just east of the park.

With regard to the livestock sector, the effects would be the same as alternative 2, with hunting as a potential additional source of income for those private holdings in the West Yellowstone area that charge for hunting on their land.

The cost of acquiring title to private properties for winter range was estimated at about $29.1 million, although no appraisals have been conducted. Purchase was estimated to cost about $4 million. These costs would be borne by the government sector. Easement costs were not estimated.

Minority and Low-Income Populations. Alternative 3 would primarily rely on hunting to control bison population growth. However, when hunting could not be used (such as when a large number of bison attempted to leave the park through the Reese Creek area), capture and quarantine or slaughter would be used as a back-up. On average, however, very few animals would likely be shot by agencies, slaughtered, or quarantined, and therefore be available to Native Americans or charitable organizations that provide food for the needy. It should be noted that any live bison completing quarantine would have a significantly higher value than bison carcasses (e.g., the average 1996 auction price for live bison from the National Bison Range was $1,800). The estimate of the value of bison donated as presented above would therefore be conservative to the extent that some of the seronegative bison removed could be donated as live animals following completion of quarantine protocol.

Social Values. There would be only intermittent shipment of bison to slaughter associated with alternative 3, and thus any impacts on humanitarian and moral values would be minor. Social values of individuals who were opposed to hunting might be to a minor or moderate degree adversely affected by the hunting activities in this alternative. Some tribes might view the hunting program, quarantine, and capture and slaughter activities as disrespectful of tribal beliefs. Ranching lifestyles could be affected north of the park boundary, but land would be expected to be purchased from willing sellers; therefore, impacts on social values regarding changes in ranching lifestyles would be minimal (see "Livestock Operations" for additional information regarding potential changes in ranching). Some residents across the country might not fully understand the science behind management of bison and perceive the animals as being an endangered species; therefore, some might oppose the management actions of this alternative.

Nonmarket Values. Alternative 3 would lead to population distribution similar, but more restricted than alternative 2. Alternative 3 would also provide for acquisition of bison winter range north of the park. Because of these similarities, it would be likely that the effect on existence values and nonmarket values associated with bison viewing would be similar to or slightly less than those estimated under alternative 2. It is estimated that the nonmarket values accruing to hunters under this alternative would be approximately $24,000.

Conclusion

The impacts of alternative 3 on the regional economy would be minor and positive due to anticipated hunter expenditures. With respect to social values, this alternative could have minor to moderate adverse impacts depending on how the public viewed the fairness and appropriateness of the proposed hunt. The impacts from the standpoint of social benefits and costs would be similar to alternative 2 in that this alternative would have a considerable range from minor negative to major positive in levels of possible benefits to society.

IMPACTS OF ALTERNATIVE 4

Analysis

Regional Economy. The bison hunt would have a slight economic impact on the local economy through expenditures made by hunters during their stay in the area. This alternative would also generate revenues for the state of Montana through collection of application fees and the awarding of 35 tag permits (compared to 75 permits in alternative 3); see table 44.

Table 44: Annual Economic Values and Expenditures Associated with Bison Hunting Opportunities in the Yellowstone Area under Alternative 4

	35 permits
Fees to Montana Department of Fish, Wildlife and Parks[1]	$31,016
Hunter Expenditures[2]	$15,380
Net Economic Value[3]	$11,191

1. The applicant number, application fees, bison tag permits, and percent to residents and nonresidents were assumed to be the same as the 1996 Wyoming hunt (2,300 applicants, $5 nonrefundable application fee, $1,688 nonresident permit, $275 resident permit, and 80% of the permits reserved for state residents).
2. The average length of stay in the area was assumed to be 3 days per hunter: 2 days of hunting and 1 additional day in the area. Length of stay for a bison hunter was estimated at 3 days in the Jackson Bison Herd Draft Environmental Assessment (1994) based on communications with agency personnel. Average daily hunter expenditures are estimated to be $146.58. This number is based on elk hunters expenditures in Montana (Duffield 1988) and adjusted to 1996 price levels. Total hunter expenditures is (3 days)(35 hunters)($146.48/hunter day).
3. Net economic value was assumed to be $106.58 per day based on the net economic value reported for elk hunting (Duffield 1988) and adjusted to 1996 price levels.

With regard to the livestock sector, the effects would be the same as alternative 1, with hunting potentially an additional source of income for those private holdings in the West Yellowstone area that charged for hunting on their land.

Minority and Low-Income Populations. Sixty-nine bison (56% of the 124 bison expected to be slaughtered or shot per year under alternative 4) would likely be donated to Indian tribes and charitable organizations per year. Based on percentages allotted during the interim management period, 13% of the bison would go to charities and 87% would go to Native Americans and affiliated organizations. The value of the donated carcasses was assumed to be equivalent to the value received in auction ($337/animal). The total annual value of the 69 donated carcasses would be $23,254. It should be noted that any live bison completing quarantine would have a significantly higher value than bison carcasses (e.g., the average 1996 auction price for live bison from the National Bison Range was $1,800). The estimate of the value of bison donated as presented above would therefore be conservative to the extent that some of the seronegative bison removed could be provided as live animals following completion of quarantine protocol.

Social Values. Alternative 4 would have impacts similar to alternative 1. While total bison removals per year would be 20% higher under this alternative than under alternative 1, a number of these animals under alternative 4 would be quarantined and donated or sold live. The somewhat offsetting impacts of higher removals and lower slaughter would likely result in this alternative, having a similar impact on social values as alternative 1. Included in total bison removals under this alternative would be a hunting component at a lesser level than alternative 3. As noted above, some of the bison completing quarantine could be made available to tribes. The numbers of animals (and the availability of alternative sources) would be such that the positive impacts on tribal cultural values would likely be minor. Some tribes might view the management actions of this alternative to be in conflict with their beliefs and values. Ranching lifestyles and associated values would be similar to alternative 1.

Nonmarket Values. The impacts would be similar to alternative 1, plus hunting benefits of $11,000.

Conclusion

The overall impacts would be similar to alternative 1. Alternative 4 would have a negligible to positive minor impact (due to hunting) on the regional economy and on nonmarket benefit accounting, compared to

alternative 1. There would be a minor to moderate adverse impact (due to the level of slaughter in this alternative, which would be about one-half the level of alternative 1) on social values associated with humanitarian and moral treatment of animals. Impacts on social values associated with ranching lifestyles would be similar to alternative 1. Some tribes might view the management actions of this alternative as being in conflict with their values and beliefs.

IMPACTS OF ALTERNATIVE 5

Analysis

Regional Economy. This alternative would have no impact on hunting. However, it would have an adverse impact on winter recreation through the plowing to pavement and accompanying loss of snowmobile access along all roads now groomed into the park from the west and east entrances, as well as access to Old Faithful from the north during the first three to five years of the management plan. Assuming the same expenditures per day as for West Yellowstone winter visitors (described under alternative 2), 1994–95 visitation levels, and that use lost at the north and east entrances would be displaced out of the region, regional expenditures would decline $1.8 to $3.2 million during the period of road closures.

The interim plan resulted in a level of slaughter in the winter of 1996–97 similar to that proposed for this alternative over the years parkwide capture and slaughter was in effect. Because of the major (50%) reduction in bison population relative to alternative 1, this alternative would have negative impacts on wildlife viewing-related visitation, and expenditures could be less than or equal to the estimated positive impacts associated with wolf recovery (about $20 million in annual visitor expenditures).

With regard to the livestock sector, aggressive brucellosis control could encourage increased livestock use of the affected areas, depending on their carrying capacities and public policies regarding land use. The affected areas could therefore become more economically important to their respective counties and the state.

Minority and Low-Income Populations. Of the 1,278 bison expected to be slaughtered or shot in four years under alternative 5, 720 (56%) would be donated to Indian tribes and charitable organizations that provided food for the needy. Based on percentages allotted during the interim management period, 13% of the bison would go to charities and 87% would go to Native Americans and affiliated organizations. The value of the donated carcasses would be equivalent to the value received in auction ($337/animal). The total value of the 720 donated carcasses would be $242,640, or $60,660 per year for four years.

Social Values. This alternative would have the highest level of slaughter of any of the proposed alternatives and would approximately equal the level of the slaughter in the winter of 1997 (but over the course of three to four years). If the assumptions made in calculating bison migration rates in other alternatives held true, alternative 5 would be most like the alternative proposed concerning bison-brucellosis in Wood Buffalo National Park. That alternative led to the largest negative response to any wildlife issue ever in Canada, primarily on humanitarian and moralistic grounds (see a discussion of the Wood Buffalo National Park example in the "Methodologies for Analyzing Impacts" section of this chapter). It appears that alternative 5 would have a moderate to major adverse impact on widely held humanitarian and moralistic attitudes in the U.S. population. For ranchers in the area, the management of brucellosis would have negligible to minor benefits on social values.

Nonmarket Values. This alternative would result in changes in the bison population that would be largest in the negative direction compared to all alternatives.

One could also quantify the values of decreased viewing opportunities under the assumption that the decreased bison herd would generate viewing values comparable to those estimated

for elk. Duffield (1991a) estimated the per visit value of a 20% decrease (due to wolf predation) in elk populations to be $0.63 for residents and $4.61 for nonresidents. These estimates would be $0.76 and $5.53 in 1997 dollars. This would lead to an aggregate value of $9.8 million for park visitors. A similar value could be derived from estimates of the annual value park visitors would place on seeing or hearing wolves (Duffield 1992). Given that bison were ranked by park visitors between wolves and elk in terms of preference for viewing, these estimates might also be approximately correct for decreases in bison populations. These values could be calibrated in terms of actual willingness to pay, but since they would, in part, be based on actual trip values (rather than charitable donations), the appropriate calibration might range up to 100% of the stated value (Bishop and Heberlein 1979). Any other analysis aside, this alternative would clearly result in social costs greatly exceeding benefits.

The quantifiable nonmarket benefits of alternative 5 are not clear. It would be possible that there could be small nonmarket benefits associated with not having bison present (benefits realized by ranchers or individuals who would suffer property damage or others who have negativistic feelings toward bison). It is also possible that there could be a nonmarket benefit for eradicating brucellosis from the Yellowstone bison herd and establishing a disease-free bison herd. However, no studies exist to quantify these potential benefits. One would expect these to be relatively small.

The annual loss in nonmarket values in winter recreation for alternative 5 would likely be more substantial than alternative 2 due to additional lost use from the north and east entrances. The range of loss would be from $6.9 million to $8.0 million. Unlike alternative 2, these losses would only occur over a three- to four-year period, so the overall impact on winter recreation of alternative 5 might not be as adverse as alternative 2. Alternative 5 would still have moderately adverse impacts on winter recreation.

Conclusion

Impacts on social values would be minor to major. There would be potentially minor to negligible benefits to ranchers when brucellosis in bison is eradicated. Placement of capture facilities throughout the park would have a major adverse impact on the social values of national park visitors and others who believe parks should not be degraded. Some tribes might view this alternative as having major impacts on their beliefs, given the high number of bison being captured, tested, and slaughtered. The overall social benefit-cost impacts associated with this alternative would appear to be major adverse impacts. Most of the costs would be associated with the reduction in bison population and therefore with the reduction in the nonmarket bison viewing opportunities.

IMPACTS OF ALTERNATIVE 6

Analysis

Regional Economy. The annual impacts on the regional economy from reductions in winter recreation use under alternative 6 would be the same as alternative 2 for the first 12 years (e.g., a loss of $656,000 to $2.0 million in expenditures per year), and like alternative 5 for the next three to four years ($1.8 million to $3.2 million per year). Because the duration of the road closures under this alternative would be much greater than under alternative 5 (13–14 years of full or partial closures under alternative 6 compared to three to four years under alternative 5), the overall negative impact of alternative 6 on winter recreation is likely to be significantly larger than the impacts of alternative 5.

Impacts under this alternative would be similar to alternative 1 in most years of the plan with respect to wildlife-viewing activities, although possibly more adverse in the later years (years 14–16) when the capture and slaughter of seropositives occurred.

With regard to the livestock sector, the impacts would be similar to alternative 5, but slower

control of brucellosis could result in increased livestock use of affected areas occurring later than alternative 5.

Minority and Low-Income Populations. Fifty-six bison (56% of the 99 bison expected to be slaughtered or shot under the first 12 years of management in alternative 6) would be donated to Indian tribes and charitable organizations per year. Based on percentages allotted during the interim management period, 13% of the bison would go to charities and 87% would go to Native Americans and affiliated organizations. The value of the donated carcasses would be equivalent to the value received in auction ($337/animal). The total annual value of the 56 donated carcasses would be $18,872. In the year 2010 there would be a one-year slaughter of approximately 826 bison, which might be similarly distributed.

Social Values. Throughout its first 12 years, this alternative has similar levels of annual slaughter as alternative 1 and is accordingly expected to have similar impacts on social values. In its 13th year, 826 bison would be slaughtered. This would be most similar to alternative 5, and would have similar impacts on social values for this short-term period. When compared to alternative 5, this alternative could also have additional negative impacts on humanitarian and moralistic values for the relatively intrusive management actions that would take place throughout the park for vaccination.

Nonmarket Values. The nonmarket impacts on wildlife viewing and existence values for the first 12 years would be negligible to minor positive when compared to alternative 1. When the three-year parkwide capture and slaughter of seropositive bison began, wildlife viewing during this phase would have minor to moderate adverse impacts.

The annual impact on winter recreation under alternative 6 would be similar to alternative 2 for the first 12 years, and the same as alternative 5 for the next three to four years. In total, alternative 6 would have a significantly greater major negative impact on winter recreationists' nonmarket values than alternatives 2 and 5.

Conclusion

Impacts on the regional economy, social values, regional economy, and nonmarket values under alternative 6 would be similar to those in alternative 1 for the first 12 years, and to alternative 5 for the second phase. Social impacts might be more adverse than alternative 1 but not as adverse as under alternative 5. Social impacts might be exacerbated due to the possible humanistic and moralistic reaction to vaccination and management activities throughout the park.

IMPACTS OF ALTERNATIVE 7: PREFERRED ALTERNATIVE

Analysis

Regional Economy. Impacts for this alternative would be similar but less adverse to alternative 5 with respect to wildlife-viewing activities.

The bison hunt would have an economic impact on the local economy through expenditures made by hunters during their stay in the area. This alternative would also generate revenues for the state of Montana through collection of application fees and the awarding of 25 tag permits (15 beginning in 2000, and 10 more in 2002) compared to 75 permits in alternative 3 (see table 45). This would be offset by the costs of administering such a hunt.

Phase 1 of the preferred alternative would enable current livestock operations to the north and west of Yellowstone National Park to continue as under the interim plan. No cattle producers in the Reese Creek area would be directly affected because the SMA would be restricted to the Eagle Creek/Bear Creek area and the Hellroaring and Slough Creek drainages. On the West Yellowstone side, producers in the Horse Butte area would manage their herds within the SMA using the same precautionary measures as now. Phase 2, by including expanded winter range for

Table 45: Annual Economic Values and Expenditures Associated with Bison Hunting Opportunities in the Yellowstone Area under Alternative 7

	25 permits
Fees to Montana Department of Fish, Wildlife and Parks[1]	$25,440
Hunter Expenditures[2]	$10,896
Net Economic Value[3]	$ 7,994

1. The applicant number, application fees, bison tag permits, and percent to residents and nonresidents were assumed to be the same as the 1996 Wyoming hunt (2,300 applicants, $5 nonrefundable application fee, $1,688 nonresident permit, $275 resident permit, and 80% of the permits reserved for state residents).
2. The average length of stay in the area was assumed to be 3 days per hunter: 2 days of hunting and 1 additional day in the area. Length of stay for a bison hunter was estimated at 3 days in the Jackson Bison Herd Draft Environmental Assessment (1994) based on communications with agency personnel. Average daily hunter expenditures are estimated to be $146.58. This number is based on elk hunters expenditures in Montana (Duffield 1988) and adjusted to 1996 price levels. Total hunter expenditures is (3 days)(25 hunters)($146.48/hunter day).
3. Net economic value was assumed to be $106.58 per day based on the net economic value reported for elk hunting (Duffield 1988) and adjusted to 1996 price levels.

bison to the north of Yellowstone National Park, would require removal of cattle from one private holding and two public grazing allotments on the west side of the Yellowstone River. Cattle grazed on these lands total about 260 cow-calf pairs. Other smaller private holdings in the area, on which no cattle are currently grazed, would also be affected. Long-term potential changes in land use in the Reese Creek SMA would be of minor consequence for the region and state. Of more significance for producers locally and statewide would be regulations underlying the establishment of SMAs, whereby free-ranging bison would not compromise Montana's class-free status.

The government sector would incur costs associated with the purchase of winter range. The cost of acquiring the private property has been broadly estimated at $29.1 million, although no appraisals have been completed. Leasing of land for bison management might be feasible, but no estimates for leasing or obtaining easements were calculated.

Minority and Low-Income Populations. Seventy-eight bison (56% of the 139 bison expected to be slaughtered or shot each year under alternative 7) would be donated to Indian tribes and charitable organizations per year. Based on percentages allotted during the interim management period, 13% of the bison would go to charities and 87% would go to Native Americans and affiliated organizations. The value of the donated carcasses would be equivalent to the value received in auction ($337/animal). The total annual value of the 78 donated carcasses is $26,286. It should be noted that any live bison that completed quarantine and were donated to tribes would have a significantly higher value that bison carcasses (e.g., the average 1996 auction price for live bison from the National Bison Range was $1,800). The estimate of the value of bison donations presented above was conservative to the extent that live bison completing the quarantine protocol were donated.

Social Values. This alternative has similar but slightly higher levels of annual slaughter to alternative 4, and would likely have similar impacts on social values. However, some people, groups, and tribes might find this alternative to have a major impact on their social values, given the management of bison within specific population levels. Impacts on ranching lifestyles would be similar to alternative 3.

Nonmarket Values. This alternative would likely lead to bison population levels in 2006 that are 12% lower than under alternative 1 (but 25% higher than current conditions). By 2011 the population under this alternative was estimated to be 23% lower than under alternative 1 and lower than any other alternative. The lower bison population would be reached through long-term tight control of population growth rather than short-term large scale slaughter (as in alternatives 5 and 6). The level of annual bison removal under this alternative would be similar, but slightly (about 25%) higher than under alternative 1. Therefore, short-term impacts on nonmarket values of management under this alternative would likely be similar to those under alternative 4. In the long term, however, the tighter population controls under alternative 7 could lead to substantially lower populations. Thus, nonmarket values associated with bison

viewing could be adversely affected, which would be similar to alternative 5.

Alternative 7 like alternatives 2 and 3 would also provide for acquisition of bison winter range, and therefore could have a significant impact on nonmarket bison existence values. Since the amount of land acquired for SMAs in this alternative would be less than alternative 3, it would be likely that the effect would be slightly less than those estimated under alternative 3. However, the impact of expanding the winter range for the bison herd still could have moderate to major positive benefits.

Conclusion

Alternative 7 would have a negligible to minor positive impact (due to hunting) on the regional economy compared to the status quo. There would be a minor to moderate adverse impact (due to the level of slaughter in this alternative, which is at about 25% higher than the level of alternative 1) on social values associated with humanitarian and moral treatment of animals. Additionally, there could be minor to moderate negative impacts on wildlife viewing-related visitor expenditures and on viewing-related nonmarket values under this alternative. Some tribes, groups, and individuals might find this alternative to be a major impact on their social values and beliefs if they opposed the management of bison within specified population levels. The overall social benefit-cost impacts, like alternative 2, would range from a moderate negative to a major positive.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

From an economic perspective there would be no irretrievable or irreversible commitments of resources affecting socioeconomics from any of the alternatives because reduced bison herds could be restored.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

The bison population reductions expected under alternative 7 could lead to a long-term (15 years and beyond) decrease in annual wildlife viewing-related visitation and an associated estimated reduction in annual visitor expenditures of up to $20 million.

UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts on socioeconomics would include reductions in winter snow-mobiling and certain other oversnow travel under alternatives 2, 5, and 6, and reductions in wildlife-viewing opportunities under alternatives 5 and 7.

SUMMARY OF BENEFITS AND COSTS

The following is a summary of benefits and costs of each of the seven alternatives. Although not complete, the information provides the reader with some comparative data (see tables 46 and 47).

Economic impacts were included from the perspective of three accounting frameworks: (1) annual benefit and cost impacts resulting under the seven different bison management plans (table 46), (2) expenditure changes and impacts on the regional economy (table 47), and (3) financial impacts. The benefit-cost summary is discussed first. Table 46 presents the net present value (NPV) estimates of benefits and costs associated with the seven alternatives. The NPV estimates are presented as differences between each alternative and alternative 1, the no-action alternative (current values). An NPV calculation, such as is presented in table 46, uses year-specific costs and benefits and a discount rate to calculate the value today of a stream of annual costs and benefits over a specific time period. In the analysis presented here, the time period over which the NPV is calculated is the 15-year period, 1997–2011. A real 7% discount

rate required by the Office of Management and Budget (1997) for benefit-cost analysis is used in these computations. The application of a discount rate values costs or benefits realized today more highly than those realized in future years. The further into the future an impact is realized, the lower its NPV would be. In the development of table 46, annual costs and benefits for each year 1997–2011 were calculated and were discounted to 1997. Annual values used have been previously detailed in this chapter on each respective impact topic. The discounted annual values were then summed to arrive at an NPV for the entire planning period.

There is a possibility that the actual values for these benefits and costs could fall outside the ranges given some stochastic occurrences or until a specific management plan is in place. This summary of impacts assumes that Montana does not lose its brucellosis class-free status or experience a tourism boycott.

Table 46 is presented in two sections: "low" estimated NPV and "high" estimated NPV. These two estimates are presented because of the considerable uncertainty associated with assigning values to some costs and benefits, particularly the nonmarket values associated with bison viewing and bison existence value.

Benefit and Cost Impacts

Bison Viewing and Existence Benefits. The benefits from the recreational viewing of bison, from the preservation of the bison for future viewing, and from the recreational viewing of the park during the winter season would be nonmarket benefits. These nonmarket benefits, as discussed earlier, are evident in an individual's willingness to pay and could be estimated by contingent valuation or travel cost model methodologies. The values used in table 46 are discussed in detail throughout the "Impacts on Socioeconomics" chapter under "Regional Economy" and "Nonmarket Values." Changes in the nonmarket benefits because of impacts on the ranching lifestyle have not been quantified.

In assigning nonmarket viewing and existence values to the alternatives, a broad range of nonmarket values derived from the economics literature, and adjusted to apply to the specifics of the bison alternatives were assigned and discounted on a year-by-year basis using the following assumptions. Nonmarket bison viewing values are driven by bison population numbers; the more bison, the more opportunity for bison viewing. A range of $0 to $9.8 million per year was derived from the literature (see discussion under "Impacts on Socioeconomics, Bison Viewing") for the annual value visitors to Yellowstone National Park might place on increased viewing opportunities. In the cases of alternatives 2, 3, 4, and 6 differences in bison populations from the status quo were too small to predict with confidence any associated change in viewing values. The viewing entries for these alternatives are therefore "not measurable." For alternatives 5 and 7, years in which bison populations fell 20% or more below, alternative 1 levels were assigned a viewing loss of $9.8 million.

Nonmarket existence values associated with bison could be driven by wildlife management land acquisition, disease prevalence, and bison removal actions. Because no information was available to estimate the impacts on existence values associated with eradication of disease (on the positive side) and bison removal (on the negative side), these impacts were assumed to be generally offsetting, and existence value estimates were based on benefits associated with land acquisition. Alternatives 2, 3, and 7 all include land acquisition as a component of their bison management programs. Alternative 2, with the largest land acquisition component, was assigned a range of annual values for existence of $1.6 million to $22.9 million (see discussion in "Impacts on Socioeconomics, Nonmarket values"). The size of the existence values for alternatives 3 and 7 were scaled to the alternative 2 numbers based on the amount spent in each alternative for land acquisition. As with the other costs and benefits, nonmarket values were assigned on a year-by-year basis and discounted to 1997.

It should be noted that a wide range is presented for bison existence values because of the considerable uncertainty associated with assigning a particular value. Some factors, such as the fact that bison are not an endangered species, and bison would only inhabit the newly acquired land during winter months, might support adoption of the lower end of the range. On the other hand, the fact that the Yellowstone area bison constitute one of the few free-ranging herds in the United States, and their home is in the world's oldest and possibly best known national parks, suggest that the upper end on the range is also plausible.

Livestock Grazing Resources. The livestock operations that are within the special management areas provide benefits to the operators in terms of net annual revenues. For livestock operators displaced from public grazing, the value of these grazing resources can be approximated by the private market lease rate (on the assumption that the public leases are as productive as the average private grazing lease in Montana), which in 1996 averaged $11.80 per AUM in Montana (Montana Agricultural Statistics Service, pers. comm. 1997). On the other hand, these leases cost only $1.35 per AUM, the lease rate on U.S. Forest Service lands. It is possible that the true productivity of these leases is reflected in the rate actually paid. Accordingly, in table 46 a range of $1.35 to $11.80 per AUM is used to value the foregone livestock grazing uses on these leases. The estimate is computed by multiplying the number of cow-calf pairs to be displaced from public grazing (found in table 18) by the number of months they are on the particular area and by the relevant lease rate. This estimation assumes that all the public grazing allotments are for four months. For private livestock operations that are purchased under the alternatives, the foregone net revenues for the livestock operator are one element in the appraised total value of the ranch and are therefore included in the purchase price of the ranch (shown as acquisition cost in table 46).

Bison Donated or Sold. Bison that are selected to be either donated or sold have value. As stated earlier, the average 1996 auction price for live bison from the National Bison Range was $1,834, while the average auction price at the Gold Trophy Show was $4,400. The salvage (hamburger) value for bison as reported by the National Bison Association in 1997 ranged between $800 for a mature cow to $1,500 for a mature bull, while during the winter of 1996–97, the Department of Livestock received only an average of $337 per bison carcass. Given this information, this summary uses $337 per slaughtered bison and $1,800 to estimate the value of bison that are removed from the park alive and that go through quarantine successfully as conservative figures.

Hunting Benefits. The benefits associated with hunting are discussed in the "Impacts on Socioeconomics." Benefits are defined as the net economic value, which is the hunter's willingness to pay over and above his actual costs and is similar to estimating a recreation and preservation benefit.

Bison Management Costs and Land Acquisition Costs. These costs include all the government agencies capital expenditures and O&M costs directly associated with the management of bison in the Greater Yellowstone Area. In particular, the costs used in this analysis are those costs listed throughout "The Alternatives" discussion. Land acquisition is a lump-sum cost in the present that will yield benefits in perpetuity. To scale this asset and cost to the 15-year time horizon, annual costs have been amortized in perpetuity. An alternative is to amortize the purchase price over 15 years, then deduct the amortized future resale price. This latter approach requires a realistic assumption on future resale price. Given historical increases in real estate values in Park County, this approach would likely result in lower (or even negative) annual costs compared to amortization in perpetuity. The agency costs included in those tables, however, do not include two costs associated with the alternatives. The first cost is the value associated with increased normal park operation and maintenance due to increased tourism. The second cost is the value associated with grooming trails, which is addressed next.

Trail Grooming Costs. The cost of grooming trails and roads in Yellowstone National Park would be another cost that varied throughout the different alternatives. Even though this would generally be a cost, in alternative 2, which eliminates the grooming of trails in certain road segments, this cost savings would be a benefit in the alternative. The cost savings range was obtained from the "Environmental Assessment on Temporary Closure of a Winter Road in Yellowstone National Park."

Other Costs. There would be several other costs associated with the seven alternatives that were not included in table 46. First, there would be the damages bison caused to private property. This would include vehicle damage in and around the park as well as damages to property located outside the park including fences and livestock. Second, there would be costs associated with possible changes in testing and vaccinating practices for livestock within a 20-mile radius of the SMAs.

Regional Economic Impacts

Changes in sales of goods and services for export outside the affected area or sales to nonresident tourism would have an economic impact on the regional economy. In addition to the direct change in expenditures in an export-base framework, there would be multiplier effects on other area businesses.

With regard to livestock lease operations that would be converted to other uses, there would be a reduction in the lease payments coming into the region. There would also be multiplier effects of lost revenue to the local economy; for example, through equipment and ranch supply purchases. With regard to tourism, changes in the number of nonresident tourists coming to the affected area would also result in expenditure changes and multiplier effects on the regional economy. Similarly, expenditures by hunters would impact the regional economy. Table 47 details those regional economic impacts that have been estimated under each of the alternatives. As detailed in the section on "Socioeconomics," changes in the livestock and tourism sectors would be generally offsetting.

Changes in expenditures in the region by governmental agencies would also impact the overall level of economic activity in the regional economy. For this reason, table 47 includes changes in bison management costs, as well as changes in road grooming costs.

Financial Impacts

The various alternatives would have financial impacts on a number of governmental entities, including changes in county and state tax revenues, changes in entry fees to Yellowstone National Park, changes in hunter fees to Montana Department of Fish, Wildlife and Parks, and changes in grazing fees to the U.S. Forest Service. These changes would all likely be relatively small in the context of the overall impacts of the alternatives and in general have not been quantified. However, as an example, changes in county tax payments due to changes in livestock operations might be estimated by multiplying the per capita tax rate by the number of livestock grazed in the SMAs. Even if the livestock were put elsewhere in the county and state, they would displace other livestock assuming all available AUMs in the county and state were currently being used. There would be no loss in property taxes on private land if the land was acquired and managed by the Montana Department of Fish, Wildlife and Parks or an easement was placed on the property. However, if the land was acquired by a federal agency, there would be potential for losses in property taxes. For example, alternative 2 proposes to acquire or place an easement on 5,600 acres of private land in the Gardiner area in order to provide a new SMA for bison. If this land was acquired by a federal agency, the potential for lost property taxes would be approximately $3,472 assuming an average tax rate for grade 3 grazing land of $0.62/acre.

Hunter fees to the Montana Department of Fish, Wildlife, and Parks were quantified. These are estimated to be $53,320 for alternative 3, $31,016 for alternative 4, and $25,440 for alternative 7.

Bison in Gardiner, Montana.

TABLE 46 : NET PRESENT VALUE OF DIFFERENCES BETWEEN CURRENT AND ALTERNATIVE-SPECIFIC BENEFITS AND COSTS*

		ALTERNATIVES						
	Current Values	1**	2	3	4	5	6	7
"Low" Net Values								
Bison viewing benefits	Not estimated	$0	$0	$0	$0	($72,746,099)	$0	($12,218,578)
Bison existence benefits	Not estimated	$0	$15,592,749	$11,703,401	$0	$0	$0	$10,289,093
Winter tourism benefits	Not estimated	$0	($13,395,642)	$0	$0	($6,734,239)	($2,594,871)	$0
Livestock grazing resources	($10,534	$0	($16,262)	($2,486)	$0	$0	$0	($2,486)
Bison donated or sold	$354,874	$0	($226,854)	($143,200)	$66,726	$47,822	$126,172	$124,358
Hunting benefits	$0	$0	$0	$166,360	$77,637	$0	$0	$55,458
Bison management costs	($5,650,516)	$0	$986,928	($125,690)	($664,236)	($2,273,845)	($2,481,376)	($3,329,331)
Land acquisition costs	$0	$0	($30,084,260)	($22,580,249)	$0	$0	$0	($19,851,518)
Trail grooming costs	($13,396)	$0	$13,396	$0	$0	$0	$0	$0
Total		**$0**	**($27,129,945)**	**($10,981,864)**	**($519,873)**	**($81,706,361)**	**($4,950,075)**	**($24,933,004)**
"High" Net Values								
Bison viewing benefits	Not estimated	$0	$0	$0	$0	($72,746,099)	$0	($12,218,578)
Bison existence benefits	Not estimated	$0	$223,171,217	$167,504,927	$0	$0	$0	$147,262,640
Winter tourism benefits	Not estimated	$0	($40,722,751)	$0	$0	($7,807,815)	($5,919,055)	$0
Livestock grazing resources	($92,060	$0	($142,133)	($21,749)	$0	$0	$0	($21,749)
Bison donated or sold	$354,874	$0	($226,854)	($143,200)	$66,726	$47,822	$126,172	$124,358
Hunting benefits	$0	$0	$0	$166,360	$77,637	$0	$0	$55,458
Bison management costs	($5,650,516)	$0	$986,928	($125,690)	($664,236)	($2,273,845)	($2,481,376)	($3,329,331)
Land acquisition costs	$0	$0	($30,084,260)	($22,580,249)	$)	$0	$0	($19,851,518)
Trail grooming costs	($171,464)	$0	$171,464	$0	$0	$0	$0	$0
Total		**$0**	**$153,153,612**	**$144,800,399**	**($519,873)**	**($82,779,937)**	**($8,274,259)**	**$112,021,280**

* With regard to distributional effects, the benefits and costs listed here generally fall on different individuals.

** Alternative 1 assumes continuation of current values.

(REPRESENTS A NEGATIVE DIFFERENCE FROM CURRENT VALUES).

DEFINITIONS OF LINE ITEMS:

Bison viewing benefits = The nonmarket value that visitors to the Yellowstone area place on increased or decreased bison viewing opportunities.

Bison existence benefits = The nonmarket value that the U.S. population places on actions to improve the habitat of and sustain the population of Yellowstone bison.

Winter tourism benefits = The nonmarket value that winter visitors to Yellowstone place on their trips.

Livestock grazing resources = The lost value of grazing resources on public lands.

Bison donated or sold = The estimated value of bison taken from the park and donated or sold to charities of Indian tribes.

Hunting benefits = The nonmarket value of bison hunting trips in the Yellowstone area.

Bison management costs = The direct expenditures by federal and state agencies to implement bison management under the alternatives.

Land acquisition costs = The cost to federal or state agencies of land acquisition under alternatives 2, 3, and 7.

Trail grooming costs = The cost to the park of grooming winter snowmobile and snowcoach trails.

Table 47: Differences between Current and Alternative-Specific Annual Expenditure Impacts

		Alternatives						
	Current Values	1*	2	3	4	5	6	7
Summer tourism expenditures								
Market - low	Not estimated	$0	Not quantified but a greater positive than winter decrease	Less than Alt. 2	$0	$0	$0	$0***
Market - high	Not estimated	$0		Less then Alt. 2	$0	Less than ($20,000,000)	Less than	Less than
Winter tourism expenditures								
Market - low	Not estimated	$0	($656,000)	$0	$0	($1,800,000)**	($1,800,000)**	$0
Market - high	Not estimated	$0	($2,020,000)	$0	$0	($3,200,000)	($3,200,000)	$0
Hunter expenditures	$--	$0	$--	$32,960	$15,380	$0	$0	$10,896
Livestock operations	$150,851	$0	($150,851)	($36,627)		$0	$0	($36,627)
Bison management expenses	$376,701	$0	($65,795)	$8,379	$44,282	$151,590	$165,425	$221,955
Trail grooming expenses - low	$2,500	$0	$2,500	$0	$0	$0	$0	$0
Trail grooming expenses - high	$32,000	$0	$32,000	$0	$0	$0	$0	$0
Total - Low		**$0**	**Negligible**	**Negligible**	**$59,662**	**($1,648,410)**	**($1,634,575)**	**$196,224**
Total - High		**$0**	**Negligible**	**Negligible**	**$59,662**	**($23,048,410)**	**($23,034,575)**	**($19,803,776)**

* Alternative 1 assumes continuation of current values.

** Alternatives 5 and 6 winter tourism expenditure losses are for years with highest impact and are not constant across 15 years of plan. Alternative 5 winter expenditure reductions are for years 1–4. Alternative 6 would have winter expenditure reductions similar to those under alternative 2 in the years 1–10 and similar to alternative 5 in years 11–14.

*** Alternative 7 summer tourism expenditure impact is estimated at 0 in the short term and less than $20,000,000 in the long term.

DEFINITIONS OF LINE ITEMS:

Summer tourism expenditures = Spending by summer visitors from outside the area on goods and services within the area.
Winter tourism expenditures = Spending by winter visitors from outside the area on goods and services within the area.
Hunter expenditures = Spending in the Yellowstone area by hunters hunting bison in the area.
Livestock operations = Lost value of grazing leases on public and private land.
Bison management expenses = The direct expenditures by federal and state agencies to implement bison management under the alternatives.
Trail grooming expenses = The cost to the park of grooming winter snowmobile and snowcoach trails.

SUMMARY OF REGULATIONS AND POLICIES

The Endangered Species Act mandates that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. The U.S. Forest Service must also consider the potential effects of their actions on sensitive species in the national forest. NPS policy also requires consideration of state and locally listed species.

The Endangered Species Act directs federal agencies to assess the effects of their proposed actions on threatened and endangered species and critical habitat for these species, to write biological assessments for these proposed actions, and consult with the U.S. Fish and Wildlife Service if any effect is anticipated. The threatened and endangered species occurring in the project area for this environmental impact statement that have the potential to be affected are the grizzly bear (threatened), gray wolf (nonessential, experimental), bald eagle (threatened), and peregrine falcon (endangered); also see appendix H. Due to its unique nature as a nonessential, experimental population, the wolf is required to be treated as threatened within national parks and national wildlife refuges and proposed for listing outside them (e.g., on the national forests). Formal consultation with the U.S. Fish and Wildlife Service is required if a "may affect-likely to adversely affect" determination is made for one or more of the threatened or endangered species. The only action alternatives with this determination are alternative 5, which has this anticipated effect on the grizzly bear, and alternative 6, which has a "may affect-likely to adversely affect" determination on bald eagles. Informal consultation will occur on the preferred alternative, alternative 7, which has a "may affect-not likely to adversely affect" determination for the grizzly bear and gray wolf and "no effect" for the bald eagle and peregrine falcon..

Sensitive species consist of both plants and animals (see appendix H) and are listed as sensitive by the regional forester for national forests in their region. Sensitive species are those for which there are viability or habitat concerns but they are not currently federally listed as threatened or endangered. For the Gallatin National Forest in Region 1 of the U.S. Forest Service, a number of vertebrate species are listed as sensitive, of which the lynx, wolverine, and trumpeter swan have the potential to be affected by bison management activities. In addition, 23 species of plants are listed as sensitive on the Gallatin National Forest. Some of these sensitive species also have the status of state species of special concern.

METHODOLOGIES FOR ANALYZING IMPACTS

The primary steps in assessing impacts on species of special concern were to determine (1) which species are found in areas likely to be affected by management actions described in the alternatives in this environmental impact statement, (2) habitat loss or alteration caused by the alternatives, (3) displacement and disturbance potential of the actions and the species' potential to be affected by activities, and (4) relative population levels and distribution of bison under the alternatives. The information contained in this analysis was obtained through best professional judgment of team members, experts not on the team (but cited in the document), and by conducting a literature review. Because quantitative information on affected species is rarely available, impacts are usually assessed qualitatively.

Bison mortality is not density-dependent (Meagher, pers. comm.) but is largely influenced by weather (density-independent); therefore, one cannot assume that a high bison population necessarily means more bison carrion for carnivores unless there is the weather event that leads to mortality. The link between high bison

numbers being better for carnivores and low numbers being worse is somewhat tenuous due to the influence of weather on bison mortality. What could be of more importance than projected bison numbers when assessing the impact of the alternatives on grizzly bears (and other carnivores) is the distribution of bison carcasses in relation to the bears that appear to be most dependent on this food source in the spring (i.e. those bears that den in and near Pelican and Hayden Valleys in the interior of the park).

The Yellowstone area is a dynamic system in which stochastic processes operate and many factors are interconnected; therefore, it is difficult to quantify or predict outcomes with great accuracy. Whether or not something is beneficial or detrimental to bears appears to be relatively easy to assess, but the degree to which it is beneficial or detrimental is difficult to determine.

IMPACTS COMMON TO ALL ALTERNATIVES

The actions described in this environmental impact statement could affect species of special concern in three ways — through management actions such as hazing or shooting; by removing habitat to build and operate capture or quarantine facilities; and indirectly by influencing the number of bison available as a food source for wildlife. The latter could further influence habitat quality for predators and carrion eaters by changing the availability, location, and timing, as well as the abundance of the food source. Human activity associated with bison management (e.g., hazing, construction of quarantine or capture facilities, and operation of quarantine or capture facilities) could also affect threatened and endangered species through disturbance leading to displacement and energy expenditure.

Construction of facilities associated with bison management could directly affect sensitive plants if these species were located on the construction site. Because capture and quarantine facilities would be sited using site-specific criteria described in "The Alternatives," including surveys and redesign or relocations of the proposed facilities if conflicts with threatened or endangered species would be likely, the impacts of these facilities will only be discussed in general terms in this environmental impact statement.

Management activities, including hazing, shooting, capture facility operation, quarantine operation, and public hunting, generally would have impacts on species of special concern that are minor, or that could be mitigated so they would be negligible. Other factors that would likely a more acute impact on threatened and endangered species, in particular the grizzly bear, would include those resulting in larger population increases or decreases such as slaughter, changes in grooming or plowing of roads, and the potential acquisition of additional winter range for bison through purchase or easement from willing sellers.

The impacts of all alternatives on the peregrine falcon would be expected to be negligible; thus, the impact sections that follow focus on the threatened grizzly bear and bald eagle; the gray wolf, classified as nonessential, experimental in the Yellowstone area; and the USFS sensitive species, lynx, wolverine, and trumpeter swan (see "Affected Environment" for more information).

Endangered Species

Peregrine Falcon. The peregrine falcon uses virtually no mammal carrion in its diet, and so would not be affected by increases or decreases in bison population numbers. Peregrines could be affected if management activities occurred near an active aerie or foraging area, although at this time, no management activities would be expected to occur near known sites. Impacts on peregrines would be expected to be negligible.

Threatened Species

Bald Eagle. Bald eagles would occasionally scavenge on large mammal carcasses; however, this would not be a large proportion of their diet. Bald eagles could be affected if management activities occurred or capture facilities were constructed near an active nest or foraging area.

In West Yellowstone, the potential to disturb nesting and foraging bald eagles through noise and human activity from hazing, shooting, and capture, and slaughter operations exists. Capture facilities on public land in West Yellowstone would need to be located to avoid eagle nesting or foraging areas.

Sensitive Wildlife Species

Although lynx and wolverine exist in the study area and might rarely feed on bison carrion, management operations or changes in bison population numbers proposed in the alternatives would have only negligible impacts on these species, except for alternative 2, in which a change in snowmobile use in the national forest would be expected. Although no known general impacts from siting facilities would be anticipated, site-specific impacts would be avoided.

Sensitive Plant Species

The alternatives would have no impacts on sensitive plant species from management operations or changes in bison population numbers. No known general impacts from siting facilities would be anticipated; site-specific impacts would be avoided through compliance with national forest and park policies protecting sensitive species.

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

Cumulative impacts are past, present, and future (reasonable and foreseeable) actions of federal, state, and private entities. For this analysis, the maps of the different alternatives were used to bound the analysis area for the effects of activities on threatened, endangered, and sensitive species. In order to be considered, the effects of actions must overlap temporally or spatially with bison distribution and management activities. Most bison management activities would be limited to relatively small areas due to the fairly limited area in which bison would likely occur outside Yellowstone National Park (stippled areas on the alternative maps), or the limited areas within the park where activities might occur under alternatives 5 and 6.

To set the context for cumulative impacts, there are numerous naturally or seminaturally occurring factors of interest in relation to the grizzly bear in particular. Whitebark pine seeds are a meaningful source of fall food for grizzly bears. In the Greater Yellowstone Area, this tree species is experiencing the beginning of an outbreak of blister rust. The disease will result in the eventual decline and potential loss of this important food. Also, grizzly bears have fed extensively on spawning trout in the spring around Yellowstone Lake. Due to the introduction of lake trout into Yellowstone Lake, native cutthroat trout populations are likely to decline, and the bear could lose an important spring food in this area of the park (R. Knight, pers. comm.). Other factors influencing grizzly bears include fluctuations in sizes of ungulate herds in and around the park, weather influences on winter kill of ungulates and the number of carcasses available in the spring to bears, and competition for carrion with other scavengers and carnivores including wolves.

Within the potential areas of bison management activities, there are some proposed timber sales on the Gallatin National Forest that have the effect of short-term displacement of threatened and endangered species from localized areas. These sales have not been planned other than naming an area in which a sale might occur. Most other public projects are fairly small in size and of limited duration and should have insignificant effects on threatened and endangered species.

Bison with gray wolf

Mattson and Knight (1992) concluded that the reintroduction of wolves to the area would likely have both positive and negative effects on grizzly bears. Slight reductions in populations of elk and bison would be probable, and interior herds may be most affected. Big game populations could become more stable allowing for a more stable supply of carrion. Elk would likely be more affected by wolves than bison. Interactions among predators would be likely, with wolves perhaps reducing coyote populations and perhaps reducing competition for carcasses. Bears should be able to displace individual wolves from kills, but might not be able to displace larger groups of wolves. Overall, the issue of how wolves and grizzly bears would interact on the biomass available in terms of prey and carrion would be uncertain. Competition for carrion in the spring between bears and wolves is likely (Servheen and Knight 1990).

The most serious threat to threatened and endangered species would be private land development and the concomitant increase in interactions between humans and these species. In the last 5 to 10 years, development has increased dramatically on private land near Yellowstone National Park. The particular areas experiencing this increase are the Yellowstone River valley (or Paradise Valley) north of Gardiner, the area in and around Gardiner, and the West Yellowstone area, particularly around Hebgen Lake. The increases in development to accommodate human habitation would decrease habitat for important wildlife species, such as grizzly bear and wolves, and also displace animals due to increased recreational activities, such as hiking, fishing, hunting, and skiing, in what was formerly high-quality land for wildlife near this development. It would be expected that this trend toward development and loss of habitat would continue indefinitely.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

The continued operation of the 13-acre capture facility at Stephens Creek and the construction and operation of two 1-acre capture facilities at West Yellowstone affects threatened and endangered species' habitat directly by removing acreage from potential habitat, and indirectly by disturbance and displacement of threatened and endangered species from management activities, such as shooting, hazing, and capture operations. This would most likely affect the grizzly bear and gray wolf that could normally use the area. However, the total acreage occupied by the facilities or over which bison management operations occurred would be small compared to habitat available for the wolf population, and the impact on the wolves would be negligible. Also, capture facilities would be most heavily used from December to February, a time of year when grizzly bears were denning and would not be disturbed; therefore, the impacts on grizzly bears from operation of the capture facilities would also be expected to be negligible.

Hazing activity near Reese Creek and West Yellowstone to return bison to the park would have the potential to disturb and displace any threatened and endangered species in the area near the hazing operation. Hazing would most likely occur in April and May, but might occur throughout the winter at the SMA boundaries. This would most likely affect the grizzly bear and gray wolf that could be using the area. Although individual animals may be affected, impacts of hazing on the population of either species would be short term and negligible. At this time, no grizzly bears or their sign have been observed prior to hazing operations at West

Yellowstone (USFS, Inman, pers. comm. 1997). Currently, hazing operations would cease if there was evidence of grizzlies being active in the area.

The management activity of agency personnel shooting bison that crossed the boundaries of tolerance under this alternative could disturb and displace individual wolves or grizzly bears. This would likely be a short-term, negligible impact, limited to the time shooters were actually in place and firing. Bears and wolves would be expected to reoccupy the area once agency personnel were gone.

Shooting bison at West Yellowstone and Reese Creek, and leaving bison viscera or other body parts in these areas would increase the chance grizzlies would occupy the area and encounter humans. Under such conditions, the possibility would increase that bears would be shot. Mitigation requiring agencies to remove bison parts from these areas between March 1, when bears begin to emerge from their dens, and the time boundary control operations ceased (usually in May, but possibly throughout the summer as well), is already in place under this alternative. This mitigating measure would continue under this and any other alternative involving shooting bison, and would reduce any potential impact from grizzly bear-human conflicts as a result of agency or private individual shooting to negligible.

Mitigating measures currently in place to avoid disturbance to bald eagles during bison hazing or removal operations would continue if this alternative (with management actions in the Horse Butte area) was selected. The measures include (1) no bison removal activity that would disturb eagles would occur within 1/4 mile of any active bald eagle nest from February 1 through May 15 (after which time bison have not been allowed in this area), and (2) activities associated with bison management within ¼ mile of open water of the South Fork of the Madison River and the Madison River and Madison Arm of Hebgen Lake are limited to 10:00 A.M. to 3:00 P.M. (when eagles are not foraging). If one or more bison capture facilities were proposed, the site-specific effects of these facilities on bald eagles would have to be analyzed and mitigation applied, if needed, to prevent negative impacts on bald eagles. Because of these measures, the impacts on bald eagles would be negligible in all alternatives except alternatives 5 and 6. In alternative 5, a capture facility is proposed inside the park along the Madison River corridor. In alternative 6 the proposed capture facility could be located anywhere other than Seven-Mile Bridge. Either alternative could have adverse impacts on bald eagles.

Under this alternative, bison could range outside the park into the West Yellowstone area (until April 30) and Eagle Creek/Bear Creek SMA. This would add about 35,000 acres to the available winter range (stippled area on the Alternative 1 map).

Alternative 1 is the baseline to which others can be compared. Under this alternative, the bison herd was modeled to increase from 2,200 animals at present to 3,100 bison in 10 years (2006), and the population would continue to increase to 3,500 in the year 2010, which would be the maximum population allowed under the model. Because of the relative slower increase (4% per year) in bison population, this alternative would have a short-term, negligible impact on grizzly bears.

Under this alternative, snowmobile grooming and use would continue as it has in the past. As discussed in the "Affected Environment" in the section on "Threatened, Endangered, and Sensitive Species," compaction of snow makes oversnow travel relatively energy-efficient for bison, allowing them to move long distances after the snow has fallen. This allows bison to exit the park to the west in the fall and winter. If an average number of bison exited the park and were captured and slaughtered as dictated under the interim management plan, enough bison would remain in the park to die over the winter and provide grizzly bears with a source of spring carrion. However, when periodic environmental events such as a severe winter occurred, bison could be reduced to low levels, and some

segments of the bison herd could be seriously reduced. This would result in a similar reduction in bison carrion, which could have a temporary, minor adverse impact on grizzly bears (Meagher, pers. comm.).

Alternative 1 has no specific measures to ensure that the bison population would remain within a given range. For this reason, and because bison would be able to exit the park on groomed trails and leave the system rather than remain as carrion, this alternative would have a potential negative impact on grizzly bears, particularly on those bears that den in the park interior where winter carrion other than bison was uncommon.

Although grizzly bears are omnivorous, (i.e., they will eat almost any plant and animal matter; see "Threatened, Endangered, and Sensitive Species" section of "Affected Environment"), some individual bears that den in the interior of the park depend on bison carrion in the spring, as little other food is available upon den emergence (male grizzly bears emerge earliest in the spring). These bears would likely be adversely affected if bison were reduced or disappeared from this area. As long as bison continued to winter and die in the interior of the park, this alternative would have only a negligible impact on the grizzly bear.

Cumulative Impacts

The additive effects of actions proposed in alternative 1, including hazing, shooting, and other human disturbances, the ongoing operation of capture facilities at Stephens Creek and in West Yellowstone, and the expected losses of bison resulting from these actions combined with potential adverse impacts from timber sales and development, would not be expected to have more than a negligible impact on any threatened, endangered, or sensitive species in the study area. Continued grooming within the park could assist bison in leaving the interior of the park, but it has not yet resulted in a loss of wintering bison in these areas (Pelican and Hayden Valleys).

Conclusion

Alternative 1, in combination with other known impacts on threatened and endangered species, would have no effect on the bald eagle (with mitigation, if needed) and peregrine falcon, would not likely adversely affect the grizzly bear (as defined by the Endangered Species Act), and would not likely adversely affect (NPS) or jeopardize (USFS) the gray wolf. Due to the status of the wolf as a nonessential, experimental population, the terminology for the determination differs between the National Park Service and the U.S. Forest Service. All impacts from this alternative on threatened or endangered species in the study area would be negligible.

IMPACTS OF ALTERNATIVE 2

Analysis

No capture, quarantine, or hunting operations, and minimal hazing would be allowed under this alternative. It would include the largest area outside the park for bison to roam, and include the modification of winter grooming activities inside Yellowstone National Park to help control bison movements.

Hazing would only be used to keep bison off private land, and it would be unlikely any wolves or grizzly bear would be disturbed.

Shooting to enforce boundaries at Buffalo Horn Creek and Yankee Jim Canyon could displace grizzly bears or wolves in the short term, although the bears would be denning for some of the time shooting would take place. This activity would most likely occur from December through May, and the average emergence date for bears is in March, so there could be some displacement. At this time, wolves have rarely ventured into the areas where shooting would likely occur at the SMA boundaries. It is possible that wolves could be displaced due to this activity in the future if wolves began to inhabit these areas. Displacement impacts on bears and wolves due to shooting operations would probably be

negligible. Carcasses and viscera outside the park would likely be removed, reducing the risk of human/grizzly bear interaction.

Under alternative 2 bison would be allowed to roam more widely outside the park (see Alternative 2 map). According to the model, this alternative would have the highest average growth rate of the bison population (7% per year) and number of bison for most years the plan would be in effect. The bison population was modeled to reach 3,500 by the year 2006. It should be noted that weather events causing a major movement of bison out of the park and beyond the outer SMA boundaries would likely lead to bison removal at the boundaries of the SMAs. This could keep the bison population below 3,500. It would also include the largest area over which bison were allowed to range, thereby increasing distribution of a possible food source. This alternative would have a moderately beneficial impact on the gray wolf and grizzly bear compared to alternative 1.

Under alternative 2, snowmobile trail grooming from the west entrance would cease. This could affect bison movements out of the park in the winter, making bison less efficient in leaving the park in the winter, and perhaps resulting in more bison carrion being available within the interior of the park in the spring. Grizzly bears in the park interior are known to use bison carrion, and bison carrion can be an especially important component of the spring diet for bears in the Hayden and Pelican Valleys emerging from their dens (Meagher, pers. comm.; see the chapter on "Threatened, Endangered, and Sensitive Species" in "Affected Environment.") For this reason, alternative 2 would have the potential for an additional minor to moderate beneficial impact on grizzly bears, particularly on those bears denning in portions of the park interior where winter carrion other than bison was uncommon.

Under this alternative, it would be expected that at least a portion of the snowmobile use that would have occurred in Yellowstone National Park would shift to Gallatin National Forest, particularly in the West Yellowstone area. Concerns have recently arisen regarding susceptibility of wolverines (Copeland 1996, 93) and lynx (USFS 1994) to disturbance. In addition, lynx are especially adapted to deep snow conditions and specialized to prey upon snowshoe hare (Weaver, pers. comm. 1997). It has been suggested that snowmobile or other packed routes into lynx habitats might allow generalist predators (e.g., coyotes and bobcats) to compete with lynx for a limited food source (Idaho Fish and Game et al. 1995). If alternative 2 was selected, which would be expected to increase winter use on the Gallatin National Forest, the increase in activities and locations would be monitored, and if needed, mitigating measures would be designed and implemented for the protection of lynx and wolverine. With mitigation, impacts would be negligible.

Cumulative Impacts

The additive effects of actions proposed in alternative 2, including the expansion of bison winter range and proposed changes in park winter road grooming would improve conditions for threatened species feeding on bison, particularly grizzly bears. It would also help offset any potential displacement impacts from timber sales and natural changes in the bears' food supply. Overall, under alternative 2, the cumulative impacts would be moderately beneficial to grizzly bears, would have a minor benefit for wolves, and would have no impact on bald eagles and peregrine falcons.

Conclusion

In comparison with alternative 1 (the baseline), alternative 2 would have a minor to moderate benefit on grizzly bears, particularly those denning in the Hayden and Pelican Valleys, by concentrating some bison in the park interior through the modification of winter grooming practices on park roads. It would also have a moderately beneficial impact on grizzly bear and gray wolf populations throughout the study area by increasing the number of bison and their distribution. If grizzly bears and wolves were

drawn outside the park to feed on bison carcasses due to increased distribution and numbers of bison, they might be subjected to a slightly higher human-caused mortality rate. This should have a negligible effect on these species and could partially offset the benefit of the potential increased distribution of bison. This alternative would have no effect on the bald eagle and peregrine falcon, and is not likely to adversely affect or jeopardize the gray wolf.

Alternative 2 would have negligible impacts on both wolverine and lynx with the addition of mitigating measures, if needed, by the U.S. Forest Service.

IMPACTS OF ALTERNATIVE 3

Analysis

In the short term, alternative 3 would differ from alternative 1 in that there would not be a capture facility at West Yellowstone, seronegative bison captured at Stephens Creek would be quarantined, and public hunting would play a role. In the long term, the Stephens Creek facility would likely be dismantled and a new, smaller facility constructed north of the park in a newly established SMA.

The construction, operation, and maintenance of capture and quarantine facilities would directly affect threatened and endangered habitat by removing acreage from potential habitat, and would indirectly affect threatened and endangered species by disturbance and displacement due to management activities, including hazing, shooting, and other operations. Although capture facilities would only operate during the winter (short term) or early spring (March 1 to April 30 in the long term), quarantine facilities would operate year-round. Locations for the quarantine facilities have not been determined and would undergo MEPA/NEPA analyses and surveys and mitigation in compliance with the Endangered Species Act if this alternative was selected. Because of this, the impact of quarantine facilities to species of special concern would be negligible.

Public hunting would be allowed if approved by the Montana Legislature. Bison would be allowed outside the park and hunted on public land. Hunting has the potential to disturb and displace the grizzly bear and the gray wolf. Although most of the hunting season (October 1 to February 28) would occur when grizzly bears were denning, bears might still be out in the fall when hunting begins. During this period, grizzly bears and armed persons might come in contact with one another with a potential result of increased bear mortality risk. However, compared with the regular season elk hunt (which runs from late October to late November), the risk would be fairly low of bison hunters and grizzly bears coming in contact. This would happen because many more elk permits would be issued than the proposed number of permits to hunt bison, elk more typically use habitats used by grizzly bears, and hunter techniques would be different for hunting elk versus hunting bison, making elk hunters more subject to contact with grizzly bears. Hunter education on species identification for grizzly bears and wolves should be conducted as a mitigating measure to ensure hunters did not kill these species while hunting bison. The impacts on either grizzly bears or wolves as a result of human interactions during bison hunting would be negligible.

Bison would be allowed to roam over a large area outside the park (see stippled areas on Alternative 3 map), and the distribution of bison as prey or carcasses would also be larger than all other alternatives except alternative 2. Bison populations would increase nearly as quickly in this alternative (6%) as in alternative 2 (7%), and modeling predicts they would reach 3,500 bison by the year 2006. Implementation of alternative 3 would have negligible impacts on the grizzly bear compared to alternative 2. Compared to the no-action alternative (alternative 1), the bison population would increase quicker, carrion would be more readily available, and grizzly bears and wolves would experience a minor beneficial impact.

The effects of snowmobile trail grooming on grizzly bears would be the same as in alternative 1.

Cumulative Impacts

The additive effects of actions proposed in alternative 3, including hazing, shooting, and other human disturbances; the ongoing operation of capture facilities at Stephens Creek and possibly in the future in Yankee Jim Canyon; the construction and operation of a quarantine facility; hunting; and displacement impacts from timber sales and development, would not be expected to have more than a minor combined impact on any threatened, endangered, or sensitive species in the study area. Potential acquisition of additional winter range and resulting predicted increases in the number of bison would have a minor beneficial impact on grizzly bears and wolves. There would be potential adverse impacts on grizzly bears from the continued grooming of roads and possible loss of bison from the interior of the park. Bison numbers were much lower before the time that winter grooming began; thus, the effects of discontinuing grooming on park interior bison at their present population would not be known.

Conclusion

Alternative 3 would have no effect on the bald eagle and peregrine falcon, is not likely to adversely affect the grizzly bear, and is not likely to adversely affect or jeopardize the gray wolf. Although this alternative would allow for public hunting of bison, it would not significantly increase the mortality risk to bears or wolves given the likely number of permits issued, the locations where bison would be present, and the fact that the grizzly bears would be denning during most of the hunting season. Therefore, impacts from hunting would be negligible. However, impacts from increases in the number of bison and the area over which they would range would be a minor benefit to grizzly bears and wolves.

IMPACTS OF ALTERNATIVE 4

Analysis

The impacts of bison management actions proposed as part of alternative 4 (capture and quarantine facilities and associated habitat removal and the hazing, shooting, and other capture and quarantine operations as a disturbing and dislocating force for threatened or endangered wildlife) have been discussed in other alternatives, although the combination of public hunting and quarantine inside the SMAs described in alternative 1 would result in different population estimates discussed below.

Bison, and hence carrion, would be removed from the ecosystem in alternative 4 either by quarantine, capture, and slaughter or hunting — the method would not affect the degree of impact on grizzly bears. According to the bison population model, this alternative would result in approximately 2,800 bison by the year 2006, about 250 or 8% lower than in alternative 1. The bison population would run an average 8% to 9% lower than under the model for alternative 1. As mentioned earlier, the uncertainty in the model estimates might be fairly large due to the deterministic nature of the model. Thus, 8% to 9% would not be biologically different from alternative 1, and thus alternative 4 would have a negligible impact on grizzly bears. In the 15-year life of the management plan, bison population numbers would remain 8%–9% lower than if the no-action alternative was adopted, primarily due to the added influence of hunting.

The impacts of a capture facility located near Horse Butte on the bald eagle are described in alternative 1.

The impacts of snowmobile grooming on grizzly bears would be the same as in alternative 1, as would be the potential mitigating measures.

Cumulative Impacts

Alternative 4 would include the combination of quarantine facilities and public hunting in the

future. Under alternative 4, the SMAs would be fairly large but exclude the area west of the Yellowstone River. There would be negligible cumulative impacts on the bald eagle and no impact on the peregrine falcon by implementation of alternative 4. Implementation of this alternative would have a negligible to minor adverse impact on grizzly bears and wolves.

Conclusion

Alternative 4, in combination with other known impacts on threatened and endangered species, would have no effect on the bald eagle (with mitigation, if needed) and peregrine falcon, is not likely to adversely affect the grizzly bear, and is not likely to adversely affect or jeopardize the gray wolf. Although this alternative would allow public hunting of bison, it would not significantly increase the mortality risk to bears or wolves given the likely number of permits issued, the locations where bison would be present, and the fact that the grizzly bears would be denning during most of the hunting season. Impacts on grizzly bears and wolves from human interactions as a result of hunting would be negligible. Hunter education on species identification for grizzly bears and wolves should be conducted as a mitigating measure to ensure hunters did not kill these species while hunting bison. The effect on grizzly bears from the slightly smaller bison population would be negligible.

IMPACTS OF ALTERNATIVE 5

Analysis

Alternative 5 would differ from alternative 1 in that the capture facilities would be located throughout the park and bison would not be tolerated outside the park.

The construction and operation of nine capture facilities at several locations would affect threatened and endangered species' habitat directly by removing acreage from potential habitat, and indirectly by disturbance and displacement due to management activities. However, capture operations would be heaviest at a time of year when grizzly bears are denning and would not be disturbed. There could be potential problems for other species of concern depending on exact facility location. Any proposed capture facility in the vicinity of Madison River would have the potential to directly affect wintering bald eagles through disturbance.

The primary impact on grizzly bears and wolves in this alternative would be the reduction in the number of bison these species would have available as food. Bison would not be allowed to roam outside the park, and an aggressive park-wide capture and slaughter program to control brucellosis would significantly decrease the number of bison available as prey or carcasses for grizzly bears or wolves.

Modeling alternative 5 showed a bison population of approximately 1,300 in the year 2000, a bison population of 1,982 in 2006, and a population of 3,188 in 2011. The initial decrease in bison numbers for the first 10 years of implementation of the alternative would have the bison population at approximately 50%–65% of what it is modeled to be under alternative 1 (no action). In the year 2011 the bison population would reach approximately 85% of the population modeled under alternative 1. In the first 10 years or more bison numbers would be substantially lower than under the no-action alternative and would biologically important with potential moderate to major negative impacts on the grizzly bear, even given the limitations of the model to deal with stochastic events such as weather.

Although some roads would be plowed to transport bison under this alternative, the effects of snowmobile grooming and road plowing would be similar on bison movements; therefore, this alternative would have the same general effect on grizzly bears as alternative 1 in promoting efficient travel for bison to the park boundaries where they would be removed from the system. However, alternative 5 would also result in major decreases in the bison population,

which would have an added effect on the carrion supply available to grizzly bears. The combination of these factors would likely have a moderate to major adverse impact on grizzly bears, particularly those in the park's interior. It would also have a moderate to major adverse impact on wolves.

Cumulative Impacts

The additive effects of actions proposed in alternative 5, including capture, shooting, and other human disturbances, and the expected losses of bison resulting from these actions combined with displacement impacts from timber sales and development, would be expected to have a negligible effect on the bald eagle, peregrine falcon, and gray wolf. The proposed capture facility at Seven-Mile Bridge would have the potential to directly affect wintering bald eagles and a nesting pair of bald eagles through disturbance. This would be a major adverse effect. The grizzly bear would experience a moderate to major adverse impact from this alternative due to a rapid decrease in bison numbers projected and the reduced area where bison were allowed to roam (park only).

Conclusion

Alternative 5, in combination with other known impacts on threatened and endangered species, would have no effect on the peregrine falcon, may affect the grizzly bear, and is not likely to adversely affect or jeopardize the gray wolf. The grizzly bear would experience a moderate to major adverse impact from this alternative. This alternative would have a major adverse impact on one pair of bald eagles that nest near the Seven-Mile Bridge if the potential capture facility was constructed at this site and also would have an impact on other eagles that winter in this area.

IMPACTS OF ALTERNATIVE 6

Analysis

Alternative 6 would differ from alternative 1 in that a capture facility would be located at Seven-Mile Bridge within the park rather than outside the park at West Yellowstone. The capture facility at Stephens Creek would remain the same. There would also be a quarantine facility, public hunting (as in alternative 3), and bison would not allowed outside the park except in the Eagle Creek area.

The impacts of capture facilities on grizzly bears and wolves have been discussed in other alternatives. They could affect these species directly by removing acreage from potential habitat and indirectly by disturbing and displacing individual species from management activities such as hazing, shooting, and other operations. The facility at Stephens Creek and the facility proposed for the Seven-Mile Bridge area would be most heavily used during a time of year when grizzly bears were denning and would not be disturbed. Wolves could be displaced from either area. The impacts on either species would be negligible.

The capture facility at Seven-Mile Bridge in alternative 6 would have the potential to directly affect wintering bald eagles through disturbance. This facility, located at the bridge, would have a major adverse impact on one pair of nesting bald eagles and other bald eagles that winter in this area (McEneany, pers. comm.).

Unlike other alternatives, the capture facility at Seven-Mile Bridge in alternative 6 would have the potential to directly affect trumpeter swans. This species is one of concern in the park, a class 2 species of special concern for the state of Wyoming, and considered a sensitive species by neighboring national forests. The Seven-Mile Bridge location is an important area year-round for a breeding pair of trumpeter swans, who occupy slow-moving water of the Madison River (crossed by Seven-Mile Bridge). This pair is one of only four attempting to breed inside the park. The park has closed the area during breeding

season for a quarter-mile around the nest to prevent human disturbance. Habitat along the Madison River near the area where this pair breeds supports up to about 110 trumpeter swans during migration. It would be unlikely that a capture facility could be built and operated without disturbing some migrating birds and the nesting pair.

This alternative would include aggressive brucellosis management actions, but numbers of bison would not fall as quickly as alternative 5, since capture and slaughter would not begin until vaccination has had its maximum effect on the bison population. Bison would also be restricted to the park and the Eagle Creek/Bear Creek area and Horse Butte (in West Yellowstone).

The model predicts that there would be approximately 3,100 bison by the year 2006 and 3,500 by the year 2010. The model used to predict population was run using two different vaccine efficacy rates, and the resulting numbers differed depending on which rate was assumed. Bison numbers increases until the year 2010, when capture and slaughter of all remaining sero-positive bison began. A large drop occurred and was followed by growth at the intrinsic rate of increase (about 8%) when brucellosis was eradicated. Under the two vaccine efficacy rates, the bison population declined in the year 2011 and dropped to an estimated 79 to 82% of what it was under alternative 1. The bison population increased again after 2011, and in 2015 was between approximately 2,900 and 3,500 depending on the vaccine efficacy. Up until 2011, this alternative was modeled to be almost exactly the same as alternative 1. Because of the assumptions inherent in the model and the inability to account for stochastic events such as weather, it was predicted that alternative 6 would have a negligible impact on grizzly bears.

Some roads would be plowed under this alternative, but the effects of snowmobile grooming and road plowing on bison movements would be similar, and therefore this alternative would not change winter bison movements (see alternative 1) from those that currently exist.

Cumulative Impacts

The additive effects of actions proposed in alternative 6, including capture, shooting, and other human disturbances, and the expected losses of bison resulting from these actions combined with potential displacement impacts from timber sales and development, would be expected to have a negligible impact on any threatened, endangered, or sensitive species in the study area except for the bald eagle. The capture facility at Seven-Mile Bridge in alternative 6 would have the potential to directly affect wintering bald eagles and a nesting pair of bald eagles through disturbance. This would be a major adverse affect.

Conclusion

Alternative 6, in combination with other known impacts on threatened and endangered species, would have no impact on the peregrine falcon, is not likely to adversely affect the grizzly bear, and is not likely to adversely affect or jeopardize the gray wolf. The numbers of bison and distribution are not very different from alternative 1; therefore, this alternative would be expected to have a negligible impact on grizzly bears. This alternative would have a major adverse impact on one pair of bald eagles that nest near the Seven-Mile Bridge and would have an impact on other eagles that winter in this area.

Alternative 6 would have the potential to have a major impact on one breeding pair of trumpeter swans and a minor to moderate impact on other trumpeter swans, a species of concern in the park and a sensitive species in neighboring national forests, that use the area around Seven-Mile Bridge where a capture facility is proposed.

IMPACTS OF ALTERNATIVE 7: PREFERRED ALTERNATIVE

Analysis

Alternative 7, the agency preferred alternative, would differ from the other alternatives in that it

would attempt to hold the bison population between 1,700 and 2,500. Differences in management would occur as the population approached either end of the range with more lethal controls employed outside the park as the population approached 2,500 and less lethal means as the population approached 1,700 animals. Bison numbers would be held to an upper limit of approximately 2,500 animals rather than the 3,500 animals in the other alternatives; however, removal actions would only occur outside the park, thus potentially allowing the population to exceed 2,500 if bison remained in the park.

Alternative 7 would include three capture facilities, a quarantine facility, public hunting, and the potential acquisition of additional winter range north of the park's Reese Creek boundary. Hazing and shooting would occur at or near SMA boundaries. As described in other alternatives, the construction, operation, and maintenance of capture and quarantine facilities would affect threatened and endangered habitat directly by removing acreage from potential habitat, and would indirectly affect threatened and endangered species by disturbance and displacement due to management activities, including hazing, shooting, and other operations.

The impacts of a capture facility near Horse Butte on the bald eagle and potential mitigating measures needed to avoid negative impacts are described in alternative 1.

Although capture facilities would only operate during the winter or early spring, quarantine facilities would operate year-round. The effects on threatened or endangered species of the capture facilities, hazing, and shooting would be short term, while the effects of the quarantine facility would likely be long term. The location of the quarantine facility has not been determined and would undergo additional analysis if located on public land, with necessary surveys and mitigation in compliance with the Endangered Species Act if this alternative was selected. Thus, the impact of quarantine facilities on species of special concern should be negligible.

Public hunting would be allowed under this alternative if approved by the Montana Legislature. Bison would be hunted on public land outside the park. Hunting would have the potential to disturb and displace grizzly bears and gray wolves. Although most of the hunting would occur when grizzly bears were in their dens, bears might be out of their dens in the fall when hunting commences. During this period the potential for contacts between hunters and grizzly bears would exist with a result in an increased bear mortality risk. However, compared with the regular season elk, the risk that bison hunters and grizzly bears would come into contact with one another would be fairly low. This would be because many more elk permits would be issued than the proposed number of bison permits, elk would more often be found in habitats used by grizzlies, and hunter techniques would be different for elk and bison. Wolves might also experience a minor increase in the risk of mortality from hunters in the area. Hunter education on species identification for grizzly bears and wolves should be conducted as a mitigating measure to ensure that hunters did not kill these species while hunting bison. The impacts on either grizzly bears or wolves as a result of human interactions during bison hunting would be expected to be minor. Mitigating measures requiring agencies to remove bison viscera and remains from the areas on the national forest where bears might occur after March 1 would be required. This would reduce the potential impact of grizzly-human conflicts to negligible.

Under alternative 7, the bison population was modeled to increase fairly rapidly to 2,705 animals (by the year 2003) and remain at this level due to the management actions employed in this alternative. In the year 2006, alternative 7 has an estimated 88% of the bison population predicted by the model for alternative 1. In the year 2011, alternative 7 has an estimated 77% of the bison in alternative 1. The bison population might exceed 2,500 under alternative 7 because if bison stayed within the park boundaries, no bison management actions would be proposed (except for use of the Reese Creek capture facility in the short term). Because of the

assumptions inherent in the model and the inability to account for stochastic events such as weather, alternative 7 would not be biologically different from alternative 1, and therefore would have a negligible impact on grizzly bears. In addition, the segments of the bear population that would be of concern in relation to losing their spring food supply would be the bears that denned in the vicinity of Pelican and Hayden Valleys. As long as bison continued to winter and die in these areas in the interior of the park, the impact on grizzly bears would be negligible. There has been concern that all bison would exit the interior of the park, and no bison or bison carrion would be left for grizzly bears emerging in the spring in these areas. Conditions that would cause this to occur would be unknown. Bison populations and movements relative to the park's interior, especially Pelican and Hayden Valleys, should be monitored to attempt to determine how many bison would be left in the park's interior each winter. If insufficient numbers of bison were deemed to be remaining in the interior, mitigation should be considered. In conclusion, alternative 7 would have a negligible impact on grizzly bears.

Cumulative Impacts

The additive effects of actions proposed under this alternative, including hazing, shooting, and other human disturbances related to bison management, the construction and operation of three capture facilities and one quarantine facility, and public bison hunting, would not likely have more than a negligible impact on grizzly bears. This would be because grizzly bears were denning during the period of much of the bison management activity with a possibility for some overlap in fall and March when bears were not in dens. Mitigating measures in the form of bison viscera removal on the national forest after March 1 to reduce the potential for conflict with grizzly bears in and near areas of human habitation and use, and hunter education for bison hunters to also help avoid bear-human conflict would enable these activities to have a negligible impact on grizzly bears.

Gray wolves might experience a negligible effect due to the slightly reduced potential availability of bison carrion under this alternative. Activities related to bison management might have some temporary disturbance and displacement effects on wolves. As a measure, hunter education for bison hunters on the identification of grizzly bears and wolves would mitigate the potential misidentification by bison hunters and reduce the risk of mortality during the bison hunting season.

The construction of a new capture facility in the Hebgen Lake area of West Yellowstone would have the potential to affect the bald eagle. Mitigating measures for the bald eagle would be needed to ensure that this alternative would have no impact on this species. Measures currently in place to avoid disturbance to bald eagles during bison hazing or removal operations would continue. These would include (1) no bison removal activity that would disturb bald eagles would be permitted within 1/4 mile of any active bald eagle nest from February 1 through May 15 (after which time bison have not been allowed in this area), and (2) activities associated with bison management within 1/4 mile of open water of the south Fork of the Madison River and the Madison River and Madison Arm of Hebgen Lake would be limited to 10:00 A.M. to 3:00 P.M. If one or more bison capture facilities were proposed, the site-specific impacts of these facilities on bald eagles would have to be analyzed, and mitigating measures would be applied if needed. Because of these measures, the impacts on bald eagles would be negligible.

Trumpeter swan numbers have been decreasing in the Greater Yellowstone Area over the past several years. Inside the park, only 21 adults were counted in spring 1997 (NPS, McEneany, pers. comm., May 30, 1997). Although the reasons for the decline are unknown, it is speculated that snowmobiling and loss of habitat in the Yellowstone region might be a contributor.

Conclusion

Alternative 7 would have no effect on the peregrine falcon and negligible impacts on the bald eagle with required mitigating measures. Alternative 7 would have a negligible effect on the gray wolf but is not likely to adversely affect or jeopardize this species.

Alternative 7 would have negligible effects on the grizzly bear from the displacement and disturbance caused by bison management activities, and from the potential availability of slightly less bison carrion under this alternative than alternative 1. However, based on modeling and comparison of alternatives above, alternative 7 is not likely to adversely affect the grizzly bear because the bison population and potential amount of bison carrion available under this alternative was not believed to be measurably different from that available under alternative 1 given the inherent natural variability in populations and mortality. If one could model the natural variability in the bison population and carrion on an annual basis, the bison numbers under all alternatives except alternative 5 would be very likely to overlap, meaning that no real or measurable difference would exist among the effects of these alternatives.

Public hunting would not significantly increase the mortality risk to bears or wolves given the likely number of bison permits issued, the locations where bison would be present, and the fact that the grizzly bears would be denning during most of the hunting season. The impact of hunting on grizzly bears and wolves as a result of human contact would be minor. Hunting education on species identification for grizzly bears and wolves should be conducted as a mitigating measure to ensure that hunters did not kill these species while hunting bison.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

There would be no irreversible (long-term or permanent) commitments of resources for any of the alternatives.

There would be some irretrievable (short-term or reversible) commitments of resources under several alternatives.

Implementation of alternative 5 might have a moderate to major adverse impact on the grizzly bear. This would be because the bison numbers would be low during the first 10 years of implementation and would climb slowly. The initial decrease in bison numbers and slow increase for the first 10 years of implementation of the alternative would have the bison population at approximately 50%–65% of what it was modeled to be under alternative 1 (the no-action alternative). In the year 2011 the bison population would reach approximately 85% of the population modeled under alternative 1. In the first 10 years or more bison numbers would likely be substantially lower than under alternative 1, and this difference between alternatives 5 and 1 would likely be biologically important, even given the limitations of the model to deal with stochastic events such as weather. Planned management activities would significantly lower bison population numbers. This would be most important if bison numbers and distributions declined and/or altered to the point that few bison would no longer winter (and die) in the interior of the park, particularly in Pelican and Hayden Valleys. This would affect bears that depended on bison carcasses in the spring when they emerged from their dens.

Mitigating measures for bald eagles, wolverine, and lynx would prevent the irreversible or irretrievable commitments of resources as related to these species. Wolverine and lynx have the most potential to be affected by alternative 2 in which snowmobile use would decrease in the national park and likely increase in the national forest. Bald eagles that nest and winter in the vicinity of the Seven-Mile Bridge would suffer a major negative impact under alternatives 5 and 6.

Operation of a capture facility in the Seven-Mile Bridge area (alternative 6) would likely result in the loss of at least one breeding pair of trumpeter swans.

Sensitive plant surveys prior to facility location would ensure that sensitive plants would not be affected.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

Under alternative 5 grizzly bear productivity could be affected in the long term. Under alternatives 5 and 6 the loss of productivity of one pair of nesting bald eagles would occur, and bald eagles wintering in the Seven-Mile Bridge area would also be negatively affected.

Loss of a breeding pair of trumpeter swans at Seven-Mile Bridge (alternative 6) and the creation of an area unsuitable for nesting could contribute to a decline in the overall productivity of the local swan population in the long term.

Implementation of mitigating measures, where needed, would ensure no loss in long-term availability or productivity of other threatened, endangered, and sensitive species.

UNAVOIDABLE ADVERSE IMPACTS

Under alternative 5, there may be unavoidable adverse impacts on the grizzly bears. Under alternatives 5 and 6, the only possible location for the Seven-Mile Bridge capture facility would have an impact on nesting and wintering bald eagles.

Operation of a capture facility at Seven-Mile Bridge (alternative 6) would result in a major adverse impact on at least one pair of breeding trumpeter swans, and could have a moderate adverse impact on the local swan population by removing several acres from availability for nesting sites.

SUMMARY OF REGULATIONS AND POLICIES

Several planning and policy documents, including the *Yellowstone National Park Master Plan* (NPS 1974), the *Yellowstone National Park Statement for Management* (NPS 1991), and the *National Park Service Management Policies* (NPS 1988) require the protection of ecological processes and native species in a relatively undisturbed setting, and require that park planning be accomplished in a regional context. The goals outlined in the *Resource Management Plan* (NPS 1995) are to "preserve the natural and cultural resources of Yellowstone and to allow natural process and interactions between resources to occur with a minimum of human influence."

The wildlife-related goals of the Gallatin National Forest as stated in the *Gallatin National Forest Plan* (1987) include the following: (1) provide habitat for viable populations of all indigenous wildlife species and for increasing populations of big game animals, (2) provide sufficient habitat for recovered populations of threatened and endangered species, and (3) strive to prevent any human-caused grizzly bear losses. The U.S. Forest Service is a multiple use agency, and in the area closest to the park that lies in the grizzly bear recovery zone, the *Forest Plan* allows for resource use (e.g., timber harvest, recreation) compatible with the recovery of the grizzly bear.

METHODOLOGIES FOR ANALYZING IMPACTS

The method used to identify impacts on other wildlife species was to initially identify which species might occupy habitat in areas where bison management activities might occur or otherwise be affected by them. A review of the available literature was conducted, to determine whether the ecological niche of bison might overlap with these species as well. This includes food choices as well as the geographical area each species occupies. Potential effects were then analyzed based on information obtained from the literature review and from accumulated knowledge about the particular species and the location and nature of bison management activities. Impacts are assessed qualitatively, due to a lack of quantitative data and quantitative methods for predicting effects.

IMPACTS COMMON TO ALL ALTERNATIVES

Elk

Hazing activities directed at moving bison into capture facilities or inside the SMA boundary might disturb and displace elk using those areas. Displacement and disturbance could increase energy expenditures and result in increased chance of mortality for some individual elk. Hazing would likely be infrequent, however, and displacement and stress would be local and temporary and would have only minor effects on the elk population. Shooting activities to control bison in boundary areas would likely have the same effect on elk as hazing.

Although elk and bison share habitat and eat similar foods, these species do not have to compete for either in the analysis area (Singer and Norland 1994). Therefore, increases or decreases in bison population numbers would not expected to affect elk through competition for food or habitat.

Pronghorn

Pronghorn winter range in the analysis area is limited, and is restricted to approximately 7,000 acres, 75% of which is within the park. This area is located between Mammoth Hot Springs and Cinnabar Mountain, with the core use area in the open grasslands near the Stephens Creek area. A bison capture facility currently exists at Stephens

Creek, and would continue to operate in all alternatives (for the short term only in alternatives 3 and 7) except alternative 2. The facility occupies 13 acres of this core use area, and removes it from winter range available to the pronghorn.

Hazing and shooting activities to manage bison in this area might have also had an adverse effect on the herd. Pronghorn could be particularly vulnerable to stress caused by human disturbance (Autenrieth 1983), and observations made during bison captures and associated activities in the winter of 1996–97 indicated that pronghorn were displaced from the area extending at least ½ mile outward from the Stephens Creek capture facility (Caslick and Caslick 1997). In addition to displacement, hazing and shooting activities could increase energy expenditures and could result in increased risk of mortality of some individuals. Because of the small size and vulnerability of this population, the loss of a few individuals could have moderate to major impacts on the population as a whole.

Hazing and shooting activities in areas other than the Gardiner Valley/Stephens Creek area would be expected to have minimal impact, if any, on pronghorn.

Yellowstone bison and pronghorn are separated by habitat selection, food habits, snow tolerance, and seasonal distribution. Therefore, increases or decreases in the number of bison would not be expected to affect pronghorn through competition for food or habitat.

Deer

Hazing and shooting activities would have a similar effect on deer as that described for elk. Fewer deer than elk would likely be affected, due to lower numbers of deer in the area and different distribution of deer on the winter range.

Although bison and mule deer experience some degree of overlap in habitat use, there appears to be little or no competition between these two species because of differing diet preferences (Singer and Norland 1994). Competition may also be precluded by seasonal distribution differences and by the limited ability of deer to deal with deep snow. Bison and white-tailed deer also appear to avoid competition through food choices. Therefore, no impacts on deer from increases or decreases in bison population sizes would be expected.

Bighorn Sheep

Hazing and shooting activities could temporarily affect a small number of sheep in the vicinity of those activities. Hazing and shooting activities would likely be very infrequent in areas used by bighorn sheep and would not have any effect on the population.

While there has been some increase in habitat overlap between bighorn sheep and bison in recent years (Singer and Norland 1994), the two species are separated ecologically by differences in distribution, diet, and tolerance of snow. During spring, bison increasingly select habitats with characteristics important to bighorn sheep, but there does not appear to be appreciable overlap or competition for the use of those areas from bison. Therefore, increases or decreases in the bison population size would not be expected to affect bighorn sheep through competition for food or habitat.

Moose

Hazing and shooting activities would be expected to have no detectable impact on the moose population. A few moose in the West Yellowstone area might be temporarily displaced by activities in that area.

Moose tend to use riparian habitats, and are not likely to compete with bison for forage or habitat. Increases or decreases in the bison population size would not be expected to have an impact on moose through competition for either forage or habitat.

One study (Forbes et al. 1996) has indicated that infection with *Brucella abortus* might be fatal to moose, while another study (Zarnke 1983) suggested that brucellosis might not be a threat to moose. Because only small numbers of moose inhabit the analysis area and they do not occupy the same habitat as bison, and because bison in the area might have few or no brucellosis-related abortions (the route of disease transmission in other ungulates), the risk of transmission would be remote (e.g., less than negligible). In addition, in all alternatives, vaccination would be used to reduce seroprevalence rates in bison. Vaccination would accomplish this in part by further reducing abortions and therefore reducing the amount of bacteria available in the environment. The selection of any alternative analyzed in this environmental impact statement would therefore further reduce the risk of transmission to moose.

Predators and Scavengers

Hazing activities directed at moving bison into capture facilities or inside the SMA boundary might disturb and displace predator and scavenger species using those areas. Hazing would likely be infrequent, however, and displacement and stress would be local and temporary and have only minor effects on those populations. Shooting activities could provide an additional food source (gut piles) for scavengers in areas where such food was not previously available. However, this would not likely represent a significant addition to the food supply for these animals, and therefore would not have more than a negligible impact on scavenger populations. Measures requiring removal of gut piles or carcasses from areas near human habitation might prevent conflicts between humans and scavengers using the additional food source.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Ungulates. Elk and other ungulates could be captured unintentionally in temporary enclosures designed to hold bison. Some animals might be unable to escape the enclosures on their own. Animals unable to escape would be separated from the bison and released. Although unlikely, bison could physically injure other ungulates that are captured with bison in the capture facilities. The additional stress might affect individual ungulates, but this should not significantly affect ungulate populations using winter range in the Stephens Creek and West Yellowstone areas.

Capture operations and associated capture facilities and wing fences would occur on critical pronghorn winter range in the Stephens Creek area. Pronghorn winter range is restricted to approximately 7,000 (7,168) acres (Houston 1982) in south end of the Gardiner Valley, west of the Yellowstone River. Wing fences and increased human activity might cause displacement of pronghorn from a portion of their winter range, and increase stress on animals. Caslick and Caslick (1997) reported that pronghorn avoided the area within about ½ mile of the Stephens Creek facility when bison management activities were occurring during the winter of 1996–97. They also reported that the center of pronghorn activity apparently shifted away from the Stephens Creek service road junction with the County Road, possibly in response to increased traffic associated with bison management activities. At least one adult pronghorn was killed by a coyote along the wing fence (Caslick and Caslick 1997). The wing fence design included a 24-inch gap under the bottom wire to facilitate pronghorn movement, but presence of the fence in a previously open area might have

confused pronghorn, which rely on rapid flight over long distances to escape predators.

Species Associated with Bison Grazing and Behavior. Habitat disturbances such as tree rubbing, trails, and wallowing occur in certain locations favored by bison, and would likely be unaffected by all but the most dramatic reductions of bison numbers (NPS, Meagher 1973). Therefore, species associated with these features would not be affected by this alternative.

Predators and Scavengers. Some bison that might otherwise have died within the park would be removed through capture and shipment to slaughter in this alternative. This removal should be of great enough magnitude to affect the food supply of scavengers.

Impacts Associated with Snowmobiling. Currently, some segments of road inside the park are groomed during the winter, and are used by winter recreationists including snowmobilers. The use of snowmobiles likely affects a wide range of wildlife species, including big game, furbearers, and small mammals. In general, snowmobiling is believed to lead to displacement and increased energetic costs of wildlife (Caslick and Caslick 1997). Winter recreation can result in harvest, habitat modification, pollution, and disturbance. These results have a number of potential impacts on wildlife species, including altered behavior, altered vigor, altered productivity, or death in the long term. The abundance, distribution, and demographics of populations could be affected, and this could result in a change in species composition and interactions among species (Knight and Cole 1995, 52). These could include alteration of wildlife movement or displacement from normal wintering areas and higher energy costs for stressed wildlife, potentially resulting in decreased production of young, and occasionally, in the case of snowmobile/wildlife collisions, direct mortality. Use of snowmobiles in thermal areas, which are of great value to wintering wildlife, would be of special concern inside the park (Caslick and Caslick 1997).

Grooming for snowmobiles, which compacts the snow, can benefit wildlife species that use these groomed trails for energy-efficient travel (Aune 1981). The presence of groomed (compacted) trails also allows species to venture into areas where they do not normally winter (Copeland 1996). This might result in adverse impacts when it allows generalist predators, such as coyotes and bobcats, to enter the winter foraging areas of specialized predators such as the lynx. The extent to which animals other than bison use groomed snowmobile roads within the park to facilitate movement in winter is not well known. The degree of impact is also unknown.

Cumulative Impacts

Human development of winter range adjacent to the Yellowstone National Park boundary, in combination with increased human activity both inside and outside the park could be causing increased disturbance and displacement of elk, mule deer, and bighorn sheep from important habitat. These activities would occur on winter range that would be critical for the pronghorn population. The current pronghorn population of approximately 220 animals is considered to be at an unacceptably high risk of extinction due to chance events such as weather, predation, and disease (Goodman 1996). Winter range available to pronghorn is limited in size and could be of suboptimal quality due in part to invasion by nonnative vegetation into the Stephens Creek area. Predation by coyotes might be causing a very low level of fawn survival, and might also be affecting adult survival. Hunting would remove a small but possibly significant number of pronghorn from the population annually. These factors, in combination with disturbance and displacement resulting from the presence and operation of the Stephens Creek capture facility, could result in a cumulative adverse impact, particularly for pronghorn.

There would be no actions proposed or now being taken that might mitigate the impacts of the capture facility. The impact of coyote predation on the pronghorn population would be unknown; therefore, the potential effect of

coyote control would also be unknown. Currently, only five permits are offered for pronghorn in the hunting district adjacent to Yellowstone National Park, in part because of concern over the low population size. The potential effect of ceasing the hunt altogether would be unknown except that 2–10 additional pronghorn might survive in the population each year. Ceasing the hunt would require action on the part of the Montana Department of Fish, Wildlife and Parks. Rehabilitation of habitat on the winter range could provide some benefit, the degree of which is unknown, but plans to do so have not been fully developed. Purchase or easement of additional winter range that would expand the area currently available to pronghorn might mitigate the effects of the capture facility at Stephens Creek.

Conclusion

The impacts of hazing and capture operations on elk, bighorn sheep, mule deer, and moose would likely be negligible. Operation of the capture facility at Stephens Creek could potentially contribute to a moderate to major decrease in the pronghorn population, through displacement of pronghorn from a portion of critical and limited winter range, through creation of a barrier to movement (wing fences), and through disturbance-related increases in energy expenditure during the critical winter period. Impacts on wildlife from the continuation of snowmobile use would not be well known, but would likely be minor as it would be confined to groomed trails. Wildlife would tend to habituate to snowmobile traffic and would use packed snowmobile routes for energy-efficient travel. No impacts on predators, scavengers, or other species associated with bison grazing and behavior from increases or decreases in bison population size would be expected as a result of this alternative.

IMPACTS OF ALTERNATIVE 2

Analysis

Ungulates. The presence and operation of a capture facility at Stephens Creek during the first phase of this alternative would have impacts similar to those described under alternative 1, although they could be less severe because they would be of shorter duration (five years compared to 15 years). Acquisition of additional winter range in the Gardiner Valley under this alternative would make more winter habitat available to elk, mule deer, and, to a lesser extent, bighorn sheep, and might result in a negligible or minor increase in the population size of these ungulates.

Acquisition of access to winter range in the Gardiner Valley would also make more winter habitat available to pronghorn. Although some pronghorn currently use private lands north of the park boundary, a hunt has been conducted for the past 10 years on those lands. The purpose of the hunt has been to remove, through hunting and associated displacement, pronghorn from agricultural land in that area. Acquisition of additional winter range in the north boundary area could remove the need for the hunt, and could lead to a moderate, or possibly major, increase in the population.

Increased bison distribution and numbers outside the park under this alternative would not likely affect other ungulate species. Singer and Norland (1994) indicated that at bison population levels at or higher than that anticipated under this alternative, no competitive effects would be detectable in other ungulate species.

Species Associated with Bison Grazing and Behavior. Habitat disturbances such as tree rubbing, trails, and wallowing occur in certain locations favored by bison and would likely be unaffected by all but the most dramatic reductions or increases of bison numbers (NPS, Meagher 1973). Therefore, species associated with these features would not be affected by this alternative.

Predators and Scavengers. Increased distribution of bison outside Yellowstone National Park might result in increased distribution of carcasses, providing food for scavengers in areas where this food source was not previously available. This would have the potential to create both positive and negative impacts on certain scavenger species. The additional food source would be beneficial but could be offset by bringing those scavengers, particularly bears and coyotes, into conflict with humans. Measures requiring removal of gut piles or carcasses from areas near human habitation might mitigate these effects.

Impacts Associated with Snowmobiling. In this alternative, roads currently groomed and used by snowmobiles in the winter might be closed to help keep bison from easily migrating outside the park. The cessation of winter road grooming from the west entrance under alternative 2 would have the effect of discontinuing snowmobile use from West Yellowstone into the park, and displacing it onto adjacent public lands outside the park. On the Gallatin National Forest, many parts of the forest, excluding wilderness areas and generally big game winter ranges, would be open to snowmobiling on or off groomed routes. The technology of snowmobiles has improved to the point that the machines are capable of going up very steep slopes and entering areas of the forest where they have not been able to travel in the past. As more snowmachines used the national forest and entered areas away from roads and trails, some species of wildlife would have the potential to be affected, and the effects could potentially be major as snowmobile use increased in areas where it had either not occurred or occurred in small amounts in the past.

Where snowmobiles were permitted over a wide-ranging area in and near big game winter ranges, as they were in the Gallatin National Forest, potentially major impacts on already stressed ungulates in the form of increased energy expenditures could occur (Caslick 1997). Predators that normally feed on these ungulates would also suffer adverse impacts from displacement. Extensive literature is now available on the effects of various forms of winter recreation on wildlife. In general, snowmobiling could lead to displacement and increased energetic costs of wildlife (Caslick and Caslick 1997).

The cessation of snowmobile grooming and snowmobile activity in the park would probably have some beneficial effects on wildlife in the park, such as reducing displacement away from groomed roads and snowmobile activity. It might also change the way in which wildlife move within the park in the winter, or at least cause animal movement to be less energy-efficient.

Grooming for snowmobiles, which compacts the snow, could benefit wildlife species that use these groomed trails for energy-efficient travel (Aune 1981). The presence of groomed (compacted) trails would allow species to venture into areas where they did not normally winter (Copeland 1996). However, it might also have major adverse impacts through competition with specialized predators such as lynx when it would allow generalized predators such as coyotes and bobcats to enter their winter foraging areas.

The extent to which animals other than bison would use groomed snowmobile roads within the park to facilitate movement in winter would be unknown. It would be likely that many species use them, and these animals would find those movements restricted by closure of roads to grooming and snowmobiling. Restricted movement could result in increased cost of movement between foraging areas and consequently decreased survival and reproduction. Conversely, the removal of a major disturbance and displacement factor (snowmobiles) could benefit some species by reducing stress and associated energy expenditure. Although the degree of impact would vary among species, restricting travel and removing snowmobiles could generally be offsetting to park wildlife.

Without mitigation, impacts of increased snowmobile uses on wildlife on the national forest would be moderately negative. With mitigation,

such as confining snowmobile use to existing trails, these impacts might be reduced to minor, although the degree of impact would be unknown. Specifically, snowmobiles may be restricted in big game habitat or other wildlife habitat during critical times of the year, such as when winters were particularly harsh or food supplies were low.

Cumulative Impacts

Cumulative impacts would be expected to be similar in the first phase of this alternative to those described under alternative 1, but less severe because the presence and operation of a capture facility at Stephens Creek was assumed to last about five years until 2002 and not 15 years as under alternative 1. Acquisition of winter habitat in the Gardiner Valley could offset the negative impacts of human development and increased human activity. Although more than one factor has likely contributed to the decline in the pronghorn population, availability of more winter range might help offset some of those influences.

Conclusion

During phase 1 of this alternative, the presence and operation of a capture facility at Stephens Creek might result in a moderate adverse impact on the pronghorn population through displacement of pronghorn from portions of critical winter habitat and creation of a barrier to movement (wing fences) in the midst of critical winter habitat.

Acquisition of additional winter range in the Gardiner Valley might slightly increase populations of elk and mule deer, by increasing the amount of winter forage available and reducing stress associated with current displacement from those areas. Acquisition of winter range in the Gardiner Valley could contribute to at least a moderate and possibly a major increase in the pronghorn population, by greatly expanding the limited winter range available to them. The degree of impact on wildlife of displaced snowmobile use to public lands outside the park would be unknown, but would likely be more adverse than under existing conditions as snowmobiles would not be restricted to trails outside the park. No impacts on predators, scavengers, or other species associated with bison grazing and behavior from increases or decreases in bison population size would be expected under this alternative.

IMPACTS OF ALTERNATIVE 3

Analysis

Ungulates. Operation of capture facilities during the first phase of this alternative would have the same impacts as those described for alternative 1. Movement of the capture facility out of the Stephens Creek area in phase two of this alternative would likely have a beneficial effect on the pronghorn population, by allowing them to again use that part of their winter range and by removing disturbances associated with operation of the facility.

Acquisition of additional winter range would have impacts similar to those described for alternative 2. The beneficial effects of habitat acquisition might be slightly offset for all ungulate species by bison hunting activities conducted within the acquired area. Hunting might create temporary and localized displacement or stress of individuals or small groups of elk, bighorn sheep, mule deer, and pronghorn.

Species Associated with Bison Grazing and Behavior. Habitat disturbances such as tree rubbing, trails, and wallowing would occur in certain locations favored by bison and would likely be unaffected by all but the most dramatic reductions or increases in bison numbers (NPS, Meagher 1973). Therefore, species associated with these features would not be affected by this alternative.

Predators and Scavengers. Viscera associated with hunting in the acquired area, in addition to winter-killed carcasses distributed over a larger area, could draw scavenger species, such as

coyotes and bears, into the area and potentially into conflict with humans. Measures requiring removal of viscera or carcasses from areas near human habitation might mitigate these effects.

Impacts Associated with Snowmobiling. No changes in existing winter road grooming would be anticipated in this alternative. Bison movements along groomed trails would be monitored, and options for restricting bison movement through blocking or closing roads researched. Any closures resulting from amendments to the park's winter use plan that restrict bison movement might also restrict the movement of other wildlife species, and research on bison movement would continue. Otherwise, impacts on wildlife from snowmobiling would be similar to those described in alternative 1.

Cumulative Impacts

Cumulative impacts would be expected to be the same as those described under alternative 1 in the short term, and the same as those described under alternative 2 in the long term.

Conclusion

The impacts of hazing and capture operations on elk, pronghorn, mule deer, and moose would not be major. During the period in which the capture facility at Stephens Creek was in operation, there would be the potential for a moderate to major impact on the pronghorn population through their displacement from portions of critical winter habitat and creation of a barrier to movement (wing fences) in the midst of critical winter habitat. Acquisition of wildlife habitat in the Gardiner Valley would have a moderate to major beneficial impact on elk, mule deer, pronghorn, and bighorn sheep by providing additional winter range that would be of limited availability. No impacts on predators, scavengers, or other species associated with bison grazing and behavior from increases or decreases in bison population size would be expected as a result of this alternative. Impacts on wildlife from the continuation of snowmobile use would be unknown, but would likely be minor as it was confined to groomed trails.

IMPACTS OF ALTERNATIVE 4

Analysis

Ungulates. Operation of capture facilities under this alternative would have the same impacts as those described under alternative 1. Hunting activities conducted under this alternative would likely have little to no effect on other ungulate species because hunting would be limited to areas in which extensive elk hunting already occurred. Bison hunting would not be conducted within pronghorn winter range.

Species Associated with Bison Grazing and Behavior. Habitat disturbances such as tree rubbing, trails, and wallowing occur in certain locations favored by bison, and would likely be unaffected by all but the most dramatic reductions or increases of bison numbers (NPS, Meagher 1973). Therefore, species associated with these features would not be affected by this alternative.

Predators and Scavengers. Scavengers feeding on gut piles would not likely come into conflict with humans any more than they currently do as a result of feeding on offal from the elk hunting season.

Impacts Associated with Snowmobiling. No changes in existing road grooming practices would be anticipated under this alternative. Therefore, impacts from snowmobiling would be the same as those described for alternative 1.

Cumulative Impacts

Cumulative impacts would be expected to be the same as those described under alternative 1. The degree to which land acquisition or easement might offset other impacts on wildlife would be dependent on whether additional winter range was acquired by purchase or easement, on the terms of easement, on the land use and manage-

ment of the acquired area, and on whether the capture facility would be moved into the acquired area and where it would be located.

Conclusion

Impacts on all wildlife species would be expected to be the same as those described under alternative 1.

IMPACTS OF ALTERNATIVE 5

Analysis

Ungulates. Capture facilities would be constructed and operated at up to nine locations within and adjacent to the park. These facilities would occupy several acres each, in areas previously available to a variety of wildlife species. Activity associated with capture operations would likely temporarily displace most wildlife from the area immediately surrounding each facility. Capture operations in the Lamar and Blacktail Plateau areas could displace elk, mule deer, pronghorn, and a variety of predators and scavengers (see below). Capture operations in the Madison River, Firehole River, and Hayden and Pelican Valley areas could displace elk. During the fall and spring elk would be present in Pelican and Hayden Valleys; they would not be present in the winter. The temporary displacement and disturbance to elk and mule deer would be expected to affect individuals but would have no effect on those populations as a whole. Little is known about the habits and habitat use of pronghorn in the Blacktail Plateau and Lamar Valley areas, but it would be unlikely that capture facilities in these locations would have a major impact on the population. As in alternative 1, operation of a capture facility at Stephens Creek could contribute to a moderate to major decline in the pronghorn population.

Species Associated with Bison Grazing and Behavior. Removal of more than half the bison population could have ecological consequences that would be difficult to assess. There is some overlap in habitat use and diets of bison, elk, and bighorn sheep, but there has been no measurable degree of interspecific competition among these species (Singer and Norland 1994). Removal of a large number of bison from Yellowstone Park could result in increased habitat and forage species available for elk and bighorn sheep. Conversely, there is evidence that bison grazing contributes to increased production and nutritional content of grasses as well as to the stability of grassland systems (Frank and McNaughton 1993; Singer 1995; Wallace 1996). Removal of large numbers of grazers (i.e., bison) could actually reduce the productivity of grasslands, at least temporarily, for other species.

Absence of bison from some areas where they previously existed could result in some minor habitat changes. Some wallows could grow in, depending on the duration of absence of bison from those areas, and result in microsite changes affecting individual mammals, birds, and insects. Absence of tree rubbing and grazing in some areas could contribute to the promotion of forest invasion into open areas, although continued grazing by large numbers of elk might offset these effects. It would be likely that the continued presence of other grazers combined with climate and fire events would contribute more to maintaining landscape characteristics than the presence or absence of bison alone.

Predators and Scavengers. Removal of more than 40% of the bison population would result in a substantial reduction in the number of winter-killed bison carcasses available to scavengers. Black bears, grizzly bears, wolves, coyotes, foxes, ravens, magpies, and many other bird and insect species rely on bison carcasses as an important food source in late winter and spring. Although elk and other ungulate carcasses would still be available, the major reduction in biomass associated with removal of so many bison from the system would likely have a moderate adverse effect on scavenger species.

Grizzly bears would be the most likely scavenger species to be affected by the reduction in availability of bison carcasses in spring. A large reduction in the number of winter-killed bison

carcasses, in combination with low availability of other natural foods, could also contribute to increased bear-human conflicts both inside and outside Yellowstone National Park. Impacts on grizzly bears are discussed in detail under "Impacts on Threatened, Endangered, and Sensitive Species."

Some scavengers might have learned to rely on carcasses available at predictable locations. Removal of such a large portion of the bison population might result in complete removal of bison from some localities within the analysis area where they previously existed. Carcasses might therefore be absent from areas where they had been predictably found. The absence of these carcasses might adversely affect individual scavengers or localized portions of scavenger populations. The impact on scavenger populations overall would likely be minor to moderately adverse.

A significant reduction in the amount of carrion available to scavengers might increase competition for the remaining carrion (i.e., elk carcasses). This competition could adversely affect some scavenger species, such as foxes, coyotes, and black bears, that might not be able to compete against larger scavengers (grizzly bears and wolves). The extent of this impact, or species that might be affected, would be unknown.

Impacts Associated with Snowmobiling. This alternative would require the plowing to pavement of some sections of road inside the park for short periods of time to facilitate transport of seropositive bison to slaughter. This would mean snowmobiles and other winter recreationists who have traditionally used the groomed roads as winter trails would be temporarily displaced, and the roads would be used intermittently by trucks and other vehicles associated with the capture operations in the park.

The extent to which animals other than bison use groomed snowmobile roads within the park to facilitate movement in winter would be unknown. Plowing of roads to access capture facilities would allow for continued use of those travel routes. The removal of a major disturbance and displacement factor (snowmobiles) could benefit some species by reducing stress and associated energy expenditure.

Unlike alternative 2, the adverse impact of prohibiting the use of travel corridors and associated increases in energy expenditure would not take place in alternative 5. However, to the extent snowmobile use was displaced from the park onto public lands in the adjacent Gallatin National Forest, impacts on wildlife as described in alternative 2 would occur. The degree of impact on forest wildlife within the Gallatin National Forest would be similar to that in alternative 2.

Cumulative Impacts

The effects of operation of capture facilities at Stephens Creek, combined with increased development outside the park, increased human activity both inside and outside the park, predation, and hunting could have a moderate to major negative effect on the pronghorn population, resulting in decreased numbers.

Increases in development and activity outside the park, combined with loss of a significant portion of their food source inside the park, might have a moderate impact on scavenger populations.

Conclusion

Operation of capture facilities throughout Yellowstone National Park would likely have minor temporary and local adverse impacts on ungulates and other species. Impacts on pronghorn of the capture operation at Stephens Creek could potentially contribute to a moderate to major decline in numbers. Although most scavengers rely on elk carcasses in addition to bison carcasses, the reduction in availability of an important late winter and early spring food source would likely create a moderate reduction in scavenger populations in specific areas.

The removal of 40% of the bison herd could result in ecological changes affecting other ungulates and minor microsite changes affecting individual mammals, birds, and insects. The degree of these impacts and species affected would be unknown.

Impacts as a result of snowmobile displacement from plowed roads might occur as snowmobile use would be expected to increase in the adjacent national forest. The impact would likely be moderately negative on wildlife for the first few years as this alternative was implemented and roads were plowed in the park.

IMPACTS OF ALTERNATIVE 6

Analysis

Ungulates. Impacts on ungulates during the first phase of this alternative would likely be similar to those described under alternative 1. The types of impacts described under alternative 5 would be the same that wildlife would experience during the second phase of this alternative, although the magnitude would not be as great as the bison population size would be much larger before the areawide capture, test, and slaughter phase began.

Species Associated with Bison Grazing and Behavior. Habitat disturbances such as tree rubbing, trails, and wallowing would occur in certain locations favored by bison, and are likely to be unaffected by all but the most dramatic reductions of bison numbers (NPS, Meagher 1973). Therefore, species associated with these features would not be affected by this alternative.

Predators and Scavengers. Some bison that might otherwise have died within the park would be removed through capture and shipment to slaughter in this alternative. Removal of a significant portion of the bison population during the capture, test, and slaughter phase could temporarily have a minor to moderate effect on scavenger species. The magnitude of this effect would be less than in alternative 5 because the bison population would be higher in alternative 6 and fewer bison would be removed.

Impacts Associated with Snowmobiling. The impacts from plowing roads for a short period of time during the winter for the years capture and slaughter operations took place would have impacts on wildlife comparable to those described in alternative 5.

Cumulative Impacts

Cumulative impacts on ungulates (pronghorn in particular) would likely be the same as those described under alternative 1 in the short term, and as those described under alternative 5 in the long term.

Conclusion

As in alternative 5, operation of capture facilities throughout Yellowstone National Park during phase 2 of this alternative might locally and temporarily affect a variety of wildlife species. Adverse impacts on scavenger populations would be less intense than in alternative 5, but similar in that they would involve the loss in a single year of several hundred bison from the ecosystem. Operation of capture facilities at Stephens Creek could contribute to a moderate to major decline in the pronghorn population. Impacts as a result of snowmobile displacement from plowed roads might occur, although the degree of impact would be unknown.

IMPACTS OF ALTERNATIVE 7: PREFERRED ALTERNATIVE

Analysis

Ungulates. Operation of capture facilities during phase 1 of this alternative would have impacts similar to those described under alternative 1. Movement of the capture facility out of the Stephens Creek area in phase 2 would likely have a beneficial effect on the pronghorn

population, by allowing pronghorn to use that part of their winter range and by removing disturbance associated with operation of the facility. Operation of a second capture facility in the Horse Butte area would not be likely to measurably affect any wildlife species because this area would not be used by other ungulates for winter range.

Acquisition or easement of additional winter range would have impacts similar to those described under alternative 2. The degree to which acquisition or easement of additional winter range might benefit wildlife would be dependent on whether habitat was purchased or easement acquired, and on the terms of easement. The beneficial effects of habitat acquisition or easement might be slightly offset for all ungulate species by bison hunting activities conducted within the acquired area. Hunting might create temporary and localized displacement or stress of individuals or small groups of elk, bighorn sheep, mule deer, and pronghorn.

Species Associated with Bison Grazing and Behavior. Habitat disturbances such as tree rubbing, trails, and wallowing would occur in certain locations favored by bison, and would likely be unaffected by all but the most dramatic reductions of bison numbers (NPS, Meagher 1973). Therefore, species associated with these features would not be affected by alternative 7.

Predators and Scavengers. Viscera associated with hunting in the acquired area, in addition to winter-killed carcasses distributed over a larger area, could draw scavenger species, such as coyotes and bears, into the area and potentially into conflict with humans. Measures requiring removal of gut piles or carcasses from areas near human habitation might mitigate these effects.

Maintenance of the bison population at or below 2,500 animals would remove, through capture and shipment to slaughter or quarantine, some bison that might otherwise have died within the park. The overall reduction in the bison population as compared to alternative 1 might have a minor negative impact on scavenger populations.

Impacts Associated with Snowmobiling. The impacts associated with snowmobiling under alternative 7 would be the same as those described for alternative 1.

Cumulative Impacts

Cumulative impacts would be expected to be similar to those described under alternative 1. Easement or acquisition of additional winter range in the Gardiner Valley might be a mitigating measure for the cumulative impacts on ungulate populations as described under alternative 2. The degree to which land acquisition or easement could offset other impacts would depend on whether additional winter range was acquired by purchase or easement, on the terms of easement, on the land use and management of the acquired area, and on whether the capture facility would be moved into the acquired area and where it would be located.

Conclusion

During the period in which the capture facility at Stephens Creek would be in operation, there would be potential for moderate to major adverse impact on the pronghorn population as described under alternative 1. Acquisition of wildlife habitat in the Gardiner Valley would likely have a moderately beneficial impact on elk, mule deer, pronghorn, and bighorn sheep, depending on the terms of acquisition or easement. Removal of bison for the purpose of maintaining the population at about 2,500 animals might have a minor negative impact on predators and scavengers. No impacts on species associated with bison grazing and behavior from increases or decreases in bison population size would be expected under this alternative.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

The effects of the Stephens Creek capture facility and associated structures and activities

(in all alternatives except alternative 2) in critical pronghorn winter range could result in an irretrievable loss of individual pronghorn antelope. The cumulative effects of the capture operation combined with predation, restricted winter range, increasing human development and activity, and other factors (see discussion on pronghorn ecology, habitat use, and food habits in "Affected Environment, Other Wildlife Species") could result in eventual irreversible loss of this pronghorn population. These impacts might be mitigated or reversed by acquisition of additional wildlife winter range in the Gardiner Valley and associated cessation of capture operations at Stephens Creek (alternatives 3 and 7).

Removal of more than 40% of the bison population (alternative 5) and the consequent reduction in the number of bison carcasses available to scavengers could result in the irretrievable loss of individual scavengers. Mortality of individual scavengers might also result from increased conflicts with humans or from competition with other scavengers for a reduced food supply.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

The impacts on the pronghorn population from bison management activities in alternatives 1, 4, 5, 6, and 7 could contribute to a long-term decline or, combined with other factors, eventual loss of the pronghorn population (see discussion on pronghorn ecology, habitat use, and food habits in "Affected Environment, Other Wildlife Species ").

UNAVOIDABLE ADVERSE IMPACTS

The capture facility and associated structures and activities in the Stephens Creek area (alternatives 1, 3, 4, 5, 6, and 7) could have a moderate to major adverse impact on the pronghorn population, by displacing pronghorn from a portion of their limited, critical winter range, by increasing stress and energy expenditures related to disturbance by humans, and by increasing vulnerability to predation.

Loss of a significant portion of late winter and early spring food supply, in the form of winter-killed bison carcasses (alternative 5), might result in moderately adverse impacts on scavenger populations, through possible increases in mortality and decreases in reproduction related to undernutrition and competition with other scavengers for a reduced food supply. Adverse impacts might also include increased mortality as a result of increased conflicts with humans.

SUMMARY OF REGULATIONS AND POLICIES

Under authority of public laws, executive order, regulations, and APHIS directive, APHIS has a brucellosis health monitoring program that provides educational information concerning the disease and assists in the prevention of brucellosis for APHIS employees. No regulations or policies regarding the protection of human health from brucellosis exist, although standard measures such as those described in the impacts section for protection from disease would apply.

METHODOLOGIES FOR ANALYZING IMPACTS

The agencies reviewed information about human brucellosis in the literature to qualitatively evaluate the risks to human health that might result from bison management.

IMPACTS COMMON TO ALL ALTERNATIVES

Based on information about transmission of brucellosis from livestock to people, bison management would not be a health risk to the general public. However, brucellosis transmission from bison to people responsible for various management actions, e.g., hunters or those dressing bison carcasses, might occur.

Transmission to people might result from contact with infectious tissues by people responsible for eviscerating or processing bison carcasses or otherwise handling infectious materials. Contact infection might occur either directly through the skin on the hands; the infection could be carried from the hands to the eyes or mouth; or, infection could occur through the splattering of uterine fluids or blood into the eye or mouth. In particular, veterinarians, lab workers or others working with carcasses or reproductive tissues of infected bison (for instance, females with placental lesions or who have aborted fetuses, or males with testicular abscesses or other lesions of the external genitalia) might be subject to higher risks of contracting the disease. Infection would also be possible as a result of inhalation of the organism by people working with bison or bison tissues, especially in poorly ventilated areas. People who ingested contaminated raw organ tissue would be at risk for infection. Also, persons responsible for vaccinating bison are at risk for accidental injection and subsequent infection with the vaccine strain of the brucella organism.

Although the risk of brucellosis transmission from bison to people could not eliminated, the potential could be significantly reduced by employing reasonable precautionary measures. These would include the following:

- Those who assist with capture operations and load live bison for shipment to slaughter would be warned to avoid direct contact with vaginal discharges; birth membranes; or, blood from animals that might have been injured during capture.

- Those who collect blood or tissue, conduct field blood tests, or give vaccinations would have to have the necessary training and skills to safely conduct these procedures, and would have to wear gloves, masks, and protective eyewear.

- Laboratory work on potentially infected tissues and fluids would be done by trained professionals using appropriate safety measures.

- Slaughterhouse workers should wear appropriate clothing and eyewear, and use standard sanitation procedures. In addition, slaughterhouses should include proper ventilation and provide safety training for their employees.

- Hunters would complete orientation, including instruction on safe procedures for field dressing bison and safe handling of meat. Instruction would emphasize avoiding contact with the uterus and the udder, with strong advice against opening the uterus of pregnant cows.

- Qualified agency officials would supervise field dressing and the removal of pregnant uteri, male external genitalia, or the entire offal from the field.

In addition to the risk of transmission of brucellosis from bison to people, there would be low to moderate risks of human injury in all actions that include handling of live bison. These injuries could occur during hazing, capture, testing, vaccination, or loading bison.

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

No cumulative impacts related to the transmission of brucellosis to humans would occur in the study area.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Alternative 1 would include capture, testing, and slaughter of bison. As described above under "Impacts Common to all Alternatives," agency personnel who collect blood samples and administer blood tests would be at risk of contracting the disease. The degree of risk to these personnel would be considered moderate. However, with the addition of precautionary measures, such as training and implementation of safe handling procedures, the risk would be negligible to minor.

People assisting with capture and loading of live seropositive bison in trucks for slaughter might be exposed to the disease through discharged fluids, birth membranes, or blood from infected animals. The risk of infection would be negligible to minor.

Personnel in charge of vaccinating would also be at minor risk from accidental injection because the available brucellosis vaccines would consist of live organisms.

Tribal representatives or those staff who assist agency personnel in cleaning and loading carcasses might also be exposed. With proper precautions, the risk would be negligible to minor.

Conclusion

The risk of transmission to people responsible for bison management would be negligible to minor if safe handling practices were employed. If safe handling practices were not used, the risk might be moderate to those who worked with fluids or birth materials from infected animals.

IMPACTS OF ALTERNATIVE 2

Analysis

Under alternative, the risk of brucellosis transmission to humans would be the lowest of all alternatives. This would be because bison would not be captured, slaughtered, tested, or vaccinated with hand injection.

Conclusion

The risk of brucellosis transmission to any bison management personnel would be negligible to minor.

IMPACTS OF ALTERNATIVE 3

Analysis

Many of the impacts described for alternative 1 would also apply to alternative 3. An additional group of people at moderate risk includes

hunters, who would come in contact with tissues during field dressing, and might handle pregnant females or their fetuses. With training, which would be considered mandatory, the risk of transmission of brucellosis to hunters would be minor.

Conclusion

The risk of transmission to people responsible for bison management and to hunters would be negligible to minor if safe handling practices and training were employed. If safe handling practices and training were not used, the risk to either hunters or to those who work with fluids or birth materials from infected animals could be moderate.

IMPACTS OF ALTERNATIVE 4

Analysis

Populations at risk in this alternative would include agency personnel involved with capture, slaughter, testing, vaccination, loading for shipment, and shooting as described above, and would be similar to alternative 1. In addition, hunters, tribal representatives, or those staff who would assist agency personnel in cleaning and loading carcasses could be exposed.

Conclusion

The risk of transmission to people responsible for bison management and to hunters would be minor if safe handling practices and training were employed. If safe handling practices and training were not used, the risk to either hunters or to those who work with fluids or birth materials from infected animals might be moderate.

IMPACTS OF ALTERNATIVE 5

Analysis

In this alternative, nine capture facilities would run simultaneously and bison would be shipped to slaughter if they tested seropositive. Given that about one-half of the population typically tests seropositive, more bison would be transported to slaughterhouses than in any other alternative. Even with safe handling practices, the increased volume of processed bison and resulting increased contact with infected body fluids or fetuses could lead to a moderate risk to veterinarians, laboratory workers, and slaughterhouse workers (e.g., those actually in contact with fluids, birth materials, or fetuses). When the test and slaughter phase ended, risk of transmission would be expected to decline markedly because the vast majority of seropositive bison would have been removed from the herd. During the succeeding monitoring phase, the risk of transmission would be negligible as there would be few if any sero-positive bison remaining in the herd.

Conclusion

The risk of transmission to people responsible for bison management would be moderate, even when safe handling practices were used during the first phase of this alternative. When the test and slaughter phase ended, the risk of transmission would be negligible.

IMPACTS OF ALTERNATIVE 6

Analysis

During the vaccination phase, impacts of alternative 6 would be the same as alternative 1. During the test and slaughter phase, impacts would be the same as alternative 5.

Conclusion

The risk of transmission to people responsible for bison management would be minor to

moderate, but more likely to be moderate. When the test and slaughter phase is completed, the risk of transmission would likely be negligible.

IMPACTS OF ALTERNATIVE 7: PREFERRED ALTERNATIVE

Analysis

Populations at risk in this alternative would include agency personnel involved with capture, slaughter, testing, vaccination, loading for shipment, and shooting as described above, and would be similar to alternative 1. In addition, hunters, tribal representatives, or those staff who assisted agency personnel in cleaning and loading carcasses might be exposed to brucellosis.

Conclusion

The risk of transmission to people responsible for bison management and to hunters would be negligible to minor if safe handling practices and training were employed. If safe handling practices and training were not used, the risk to either hunters or to those who work with fluids or birth materials from infected animals might be moderate.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

There would be no irreversible or irretrievable commitments of resources under any of the alternatives.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

There would be no loss in long-term availability or productivity of the resource to achieve short-term gain under any of the alternatives.

UNAVOIDABLE ADVERSE IMPACTS

Direct contact with fluids and reproductive materials from infected bison would present some risk of transmission of the disease to bison management personnel.

Bison in holding pens at Stephens Creek capture facility, 1997.

SUMMARY OF LAWS, REGULATIONS, AND POLICIES

All federal actions affecting cultural resources are subject to the provisions of the National Historic Preservation Act of 1966, as amended; the National Environmental Policy Act; the Native American Graves Repatriation Act; the American Indian Religious Freedom Act; the Advisory Council on Historic Preservation's *Implementing Regulations Protection of Historic Properties* (36 CFR 800); *The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation* (FR 48:44716-40); and federal agency responsibilities under section 110 of the National Historic Preservation Act (FR 53:4727-46). Other applicable legislation, regulations and specific management procedures are detailed in the *Cultural Resources Management Guideline* (NPS-28).

The *National Park Service Management Policies* state that cultural resources are to be preserved and appreciation of the resources should be fostered through appropriate programs of research, treatment, protection, and interpretation.

Gallatin National Forest standards require that cultural resources are to be inventoried, evaluated, and preserved for enhancement and protection purposes (*Gallatin National Forest Plan*, II-17).

Section 106 of the National Historic Preservation Act requires a federal agency to take into account the effects of its undertaking on properties included in, or eligible for inclusion in, the National Register of Historic Places. This also applies to properties not formally determined eligible, but which meet eligibility criteria. Section 110 of the act requires that federal agencies establish a program to identify, evaluate, and nominate properties to the national register. It also requires agencies to act as necessary to minimize harm to historic properties adversely affected by a federal proposal, requires consultation with the state's historic preservation officer when historic resources are potentially affected, and gives the Advisory Council on Historic Preservation an opportunity to comment. In summary, the section 106 process requires the identification of resources that would be affected by a federal proposal, their evaluation under national register criteria, an assessment of proposed impacts on those resources, and consideration of ways to avoid, reduce, or mitigate adverse impacts.

METHODOLOGIES FOR ANALYZING IMPACTS

In this environmental impact statement various bison management options would be explored, including the building of quarantine and capture facilities that would not only affect archeological sites, but also the bison and the landscape they inhabit. Effects on cultural resources primarily would result from the construction of facilities to support various bison management options. For example, construction of corrals and fences would have the potential to affect prehistoric and historic resources. The number of facilities would vary among alternatives.

It should be noted that the cultural landscape(s) of the Yellowstone area have not been evaluated under national register criteria. However, these resources must be treated as eligible until otherwise documented. Under National Register of Historic Places criteria, historic properties retain integrity through their ability to convey historical significance. This concept is comprised of the seven aspects of integrity, which include location, design, setting, materials, workmanship, feeling, and association. For example, the presence of bison contributes to the location, setting, feeling, and association aspects of the integrity and significance of the cultural landscape of Yellowstone National Park. The presence of bison also constitutes a significant resource. The management of these resources

might in turn have effects on other resources. In preparing for any ground-disturbing activities, the project area would be assessed for cultural landscapes.

Assessment of impacts on cultural resources followed a four-step process outlined in the advisory council's revised regulations:
(1) identify the area of potential effect of the proposed action, (2) compare that location with that of resources listed in or eligible for listing in the National Register of Historic Places,
(3) identify the extent and type of impact of the proposed action on national register properties, and (4) assess these effects according to procedures established in the regulations.

An effect on a historic property would occur if an undertaking had the potential of changing in any way the characteristics that qualify that property for inclusion in the national register. If the proposed action diminished the integrity of such characteristics, it would be considered to have an adverse effect. Effects that might occur later than or at a distance from the location of the undertaking would also have potential impacts of the action. These would be indirect effects.

IMPACTS COMMON TO ALL ALTERNATIVES

Bison are significant to the cultural and spiritual lives of many Native American tribes. The specific significance of bison in tribal life varies from tribe to tribe. To adequately assess the impacts, it is important that representatives of each tribe articulate the specific impacts on their tribe of the alternatives. Their comments will be incorporated into the final document.

In all alternatives proposing construction of bison management facilities, site-specific surveys would be conducted prior to ground-disturbing activities. Any resources uncovered in the surveys would be evaluated under national register criteria in consultation with the state historic preservation officer. Every effort would be made to avoid known archeological resources. Should avoidance prove impossible, the National Park Service, Gallatin National Forest, and state agencies would develop mitigating measures in consultation with the state historic preservation officer and the advisory council. Should unknown resources be uncovered during construction, work would be stopped in the project area, and the agencies would consult according to 36 CFR 800.11 and as appropriate, provisions of the Native American Graves Protection and Repatriation Act.

Each alternative would seek to retain the presence of bison within varying areas of their historic range; however, bison would be killed while occupying historic range if they are outside Yellowstone National Park or the SMAs. This management action would have a moderate to major negative impact on the cultural resource the bison herd represented.

Based on current information, the physical appearance of bison does not appear to be affected by the presence of the *Brucella* organism. In all alternatives except alternative 2, the process of monitoring and vaccinating bison would change their appearance. Bison would be identified by a small metal ear tag and visual marker to indicate that they had tested negative for the *Brucella* organism. These actions would alter the historic image of the bison and would have a negligible impact on the landscape.

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

Archeological resources can be at risk from development, natural occurrences, and human activity. Proposed construction of facilities could add to this loss, although the losses of any proposal could be mitigated through avoidance and data recovery. Similarly, the cumulative effect of construction of facilities could add to the loss of undisturbed historic landscapes in specified locations in the Greater Yellowstone Area.

Sketch of Indian and buffalo, by American naturalist Titian Ramsey Peale, 1832. (NPS photo)

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Capture facilities at Stephens Creek and on the Madison River and Duck Creek already exist, and there would be no additional impact on archeological resources beyond what has already occurred.

Capture facilities at Stephens Creek and on the Madison River and Duck Creek would continue to have an impact on the landscape of those areas. Because the facilities on the Madison River and Duck Creek would be temporary and those at Stephens Creek would be compatible with nearby Yellowstone National Park wrangling facilities, the effect would be negligible.

Bison would occupy historic ranges in Yellowstone National Park and would be allowed to inhabit some other historic foraging areas in the Eagle Creek/Bear Creek area, along Hellroaring and Slough Creek, near Silver Gate and, during the winter, in the West Yellowstone area, including public lands on Horse Butte and in the Cabin Creek Recreation and Wildlife Management Area. This would ensure the presence of bison on segments of historically occupied range. However, bison would not be allowed to occupy winter range inside Yellowstone National Park in the Stephens Creek area north about 2 miles to the Reese Creek boundary.

Cumulative Impacts

This alternative would not add to the loss of archeological resources nor would it add to the loss of undisturbed landscapes. Thus, it would protect and maintain a remnant herd of free-ranging bison on the landscape, although the amount of available habitat would be limited.

Conclusion

There would be no impacts on archeological resources, nor additional impacts on landscapes. Bison would exist on historic ranges within most areas of Yellowstone National Park and limited historic winter range outside the park.

IMPACTS OF ALTERNATIVE 2

Analysis

Removal of capture facilities at Stephens Creek on the Madison River and Duck Creek near the western boundary of Yellowstone National Park could result in disturbance of unknown archeological resources. Because any impact would be mitigated through procedures described above in "Impacts Common to All Alternatives," the loss of archeological resources would be minor. Removal of structures would have a beneficial impact on the landscapes; however, the degree of benefit could be determined until a cultural landscape study was completed.

If alternative 2 was implemented, bison could inhabit the largest portion of their historic ranges inside and outside Yellowstone National Park of any of the alternatives. This would ensure the presence of bison on historically occupied range and would promote a greater understanding of the historic Great Plains and seasonal movement of bison in and around the northern Yellowstone area range.

Cumulative Impacts

Removal of capture facilities on Stephens Creek and near the western boundary of Yellowstone National Park could add to the loss of archeological resources but would have a beneficial impact on the historic landscapes of the area. The cumulative effect on free-ranging bison and the landscape would be the same as alternative 1, except that bison could range over a larger area.

Conclusion

Any potential loss of archeological resources associated with removal of bison management facilities at Stephens Creek and near the western boundary of the park could be mitigated. The removal of these structures would have a beneficial impact on the historic landscape. Free-ranging bison would be protected and maintained on historic landscapes inside and outside Yellowstone National Park.

IMPACTS OF ALTERNATIVE 3

Analysis

The construction of quarantine facilities in Montana and relocation of the Stephens Creek capture facility north of the park boundary could result in the disturbance of as yet unknown archeological resources. Because any impacts would be mitigated through procedures described in "Impacts Common to all Alternatives," the loss of archeological resources would be minor.

Relocation of the Stephens Creek capture facility and construction of quarantine facilities on public or private lands north of the park boundary would have a beneficial impact on the landscape at Stephens Creek, but would introduce new elements into the landscapes outside Yellowstone National Park. The degree of impact on the landscape would depend on location and design and results of a cultural landscape assessment.

Implementation of alternative 3 would ensure the presence of free-ranging bison in a larger portion of their historic range than alternative 1, but a smaller portion than alternative 2.

Cumulative Impacts

Construction of facilities could add to the loss of archeological resources, although the loss could be mitigated. Construction/relocation of facilities would have a beneficial impact at Stephens Creek, but might add to the loss of undisturbed landscapes in new areas. The cumulative effect of maintaining free-ranging bison on the landscape would be the same as in alternative 1.

Conclusion

Construction and/or relocation of facilities could disturb archeological resources; however, with mitigation the impacts would be minor. Construction and/or relocation of facilities would have beneficial impacts on the landscape in Yellowstone National Park and might have negative impacts in other new areas. The presence of bison on a portion of their historic ranges in Yellowstone National Park and land outside the park would be ensured.

IMPACTS OF ALTERNATIVE 4

Analysis

Construction of a quarantine facility and relocation of bison capture facilities on the Madison River in the western SMA outside the western boundary of Yellowstone National Park (if required) could disturb unknown archeological resources. Because impacts would be mitigated using procedures described in "Impacts Common to All Alternatives," the loss of resources would be minor. The Stephens Creek facility has already been built, and there would be no new impacts on cultural resources as a result of continuing to use this facility.

Construction of a quarantine facility and relocation of bison capture facilities (if required) in the western SMA area would be an intrusion on the landscape. The degree of impact on the landscape would depend on location and design and results of a cultural landscape assessment.

Bison would inhabit historic ranges in most areas of Yellowstone National Park, except Stephens Creek. As in all other alternatives except alternative 5, some bison would be allowed to inhabit historic foraging areas outside of the park in the Eagle Creek/Bear Creek area, along Hellroaring and Slough Creek, near Silver Gate and, during the winter, in West Yellowstone. This would ensure the presence of bison on a limited portion of their historic ranges.

Cumulative Impacts

Construction of facilities could disturb as yet unknown archeological resources. However, the impact could be mitigated. Construction of facilities would also affect the landscape, depending on location and design. The cumulative impact on free-ranging bison on the landscape would be the same as in alternative 1.

Conclusion

Archeological resources could be affected by construction of facilities, although with mitigation the impacts would be minor. The effect of construction on the landscape would depend on location and design. Bison would continue to inhabit historic ranges within Yellowstone National Park, and might inhabit historic rangeland outside the park.

IMPACTS OF ALTERNATIVE 5

Analysis

The construction of temporary capture and testing facilities at Lamar/Crystal Bench, Blacktail Plateau, Madison River, West Yellowstone boundary area, Old Faithful/Firehole River, and Hayden and Pelican Valleys could disturb as yet unknown archeological resources. Because any impacts could be mitigated using procedures in "Impacts Common to all Alternatives," the loss of archeological resources would be minor. There would be no new impacts from the existing Stephens Creek facility.

The landscape would be temporarily affected by the proposed bison management facilities in the areas mentioned above. The landscapes of these areas are highly sensitive. While the facilities would be temporary and every effort would be made to minimize the intrusion through design, the impact on the landscape would be significant in the short term.

In addition, fewer bison would inhabit historic ranges within Yellowstone National Park while none could range outside the park.

Cumulative Impacts

Construction of facilities would add to the loss of archeological resources, although impacts would be mitigated. The impacts on the landscape would be major in the short term. Available habitat for free-ranging bison would be restricted and their numbers greatly reduced.

Conclusion

Archeological resources could be disturbed by construction of facilities, although the effect would be mitigated. The loss of undisturbed landscapes would be temporary but major. Limited available habitat (none outside the park) would be available to free-ranging bison and their numbers would be reduced. Bison would also not likely inhabit areas where they were previously found because of reduced numbers. This is a short term, major impact on the cultural resource the bison herd represents.

IMPACTS OF ALTERNATIVE 6

Analysis

In phase one, construction of capture and testing facilities, could disturb currently unknown archeological resources at Seven-Mile Bridge. In phase two, archeological sites could also be disturbed by the construction of facilities at Lamar/Crystal Bench, Blacktail Plateau, Madison River, West Yellowstone boundary area, Old Faithful/Firehole River, and Hayden and Pelican Valleys. With mitigation described in "Impacts Common to all Alternatives," the loss of archeological resources would be minor. The Stephens Creek facility already exists, and there would be no new impacts at that location.

Construction of capture and testing facilities at Seven-Mile Bridge (phase one) and temporary facilities at Lamar/Crystal Bench, Blacktail Plateau, Madison River, West Yellowstone boundary area, Old Faithful/Firehole River, and Hayden and Pelican Valleys (phase two) would affect the landscape of those areas. The landscapes of these areas would be highly sensitive. Phase two facilities would be temporary, and while every effort would be made to minimize the effect through design, the impact would be major as long as the structures existed.

In phase two, the numbers of bison on historic ranges in Yellowstone National Park would be reduced and the herd would be limited to the portion of their historic ranges inside the park, and outside the park at the Eagle Creek/Bear Creek SMA, the West Yellowstone area of the western SMA, and along Hellroaring Creek and Slough Creek drainages.

Cumulative Impacts

Archeological resources could be disturbed by construction of facilities, although the impacts could be mitigated. The proposal would add to the loss of undisturbed landscapes in Yellowstone National Park in phase one and eight more in phase two. Limited numbers of bison would occupy historic rangelands in Yellowstone National Park and available habitat (outside the park) would be reduced.

Conclusion

Archeological resources could be disturbed by construction of facilities, although the loss would be mitigated through procedures found in "Impacts Common to all Alternatives." With mitigation, the effects would be minor. Construction of bison capture facilities would have a major impact on the landscapes in the short and long term. Bison would be present on historic ranges in the park and in limited areas outside the park.

IMPACTS OF ALTERNATIVE 7: PREFERRED ALTERNATIVE

Analysis

Dismantling the Stephens Creek capture facility (phase two) and moving it to a new site north of the park boundary, relocation of the capture facility on the Madison River to the Horse Butte area to take advantage of changing bison migration routes, and construction of a quarantine facility could result in the disturbance of unknown archeological resources. Because impacts could be mitigated through procedures described in "Impacts Common to All Alternatives," the impact would be minor. Continued operation of the state of Montana capture facility on private land at Duck Creek would not have an additional impact on archeological resources.

Construction of facilities north of the park boundary and at Horse Butte would intrude on the landscapes. The degree of impact of constructing facilities in a previously undisturbed landscape would depend on location and design and results of a cultural landscape assessment. Removal of the facilities at Stephens Creek and Madison River would have a beneficial impact on the historic landscape.

Bison would be present on historic rangeland in Yellowstone National Park as well as on limited historic foraging areas outside the park. In phase two, some bison might also be allowed to occupy lowlands between the park boundary and Yankee Jim Canyon.

Cumulative Impacts

Grading, digging, and other earth-moving activities associated with building in the Greater Yellowstone Area and park have already disturbed archeological resources of the area. To the extent these actions are part of the proposed action, the effect would be additive on these resources. Construction of bison management facilities would affect the cultural landscape, but the extent of this impact would be directly related to location and design of these facilities and thus would be unknown at this time.

Conclusion

Cultural resources could be affected from a negligible to minor degree by removal of existing facilities and construction of new ones. This alternative would ensure the presence of bison on historic rangelands in Yellowstone National Park as well as on some lands outside the park, although the number of bison would be reduced. A moderate to major reduction in bison population numbers compared to alternative 1 would adversely impact the cultural resource the bison herd represents.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

Loss of archeological resources would be an irretrievable commitment of cultural resources. However, information that would be obtained through data recovery would mitigate the loss.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

There is a potential loss of archeological resources in any construction, removal, or relocation of facilities. However, the information would be retained through data recovery.

UNAVOIDABLE ADVERSE IMPACTS

Alternatives 5 and 7 and phase two of alternative 6 would result in major reductions in the number of free-ranging bison and adversely affect the cultural resource the herd represented.

SUMMARY OF REGULATIONS AND POLICIES

The National Park Service has not developed a visual resource management system for public lands under its jurisdiction; however, the overriding management purpose in a park is preservation of all significant resources, including the scenery. The National Park Service organic act states that one of the fundamental purposes of a national park is "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such a manner and by such means as would leave them unimpaired for the enjoyment of future generations."

Visual quality objectives within the Gallatin National Forest project areas range from preservation, retention, and partial retention to modification and maximum modification of existing visual qualities. The U.S. Forest Service would require all activities proposed on public lands to meet visual quality objectives for a specific area based on suitability within a given landscape and visibility from critical viewpoints.

METHODOLOGIES FOR ANALYZING IMPACTS

Impacts on visual resources and landscapes have both a physical component and a viewer component. Visual resource changes are analyzed by comparing the existing visual character of the landscape and the degree to which the actions contrast or conform with that character.

The opportunity to observe bison was assumed to vary with population size. Therefore, numbers of bison calculated via the deterministic, or averaging, model explained in "Impacts to Bison Population" were used to predict impact from availability of bison to those trying to view them. For those finding increases in the bison herd size problematic, a wide range of social values was assumed and applied to determine impact.

Actions described in the alternatives that could have an impact on visual resources were the focus of this analysis. These include capture, test, slaughter, quarantine, hazing, agency shooting, and hunting.

IMPACTS COMMON TO ALL ALTERNATIVES

The process of monitoring and vaccinating bison would temporarily change their "wild" appearance. Bison would be visibly marked with tags and stripes due to vaccination and testing procedures. These processing marks would detract from the natural appearance of the animal. This would be a short-term, moderately adverse impact on the viewer, photographer, and others interested in seeing bison.

Agency shooting of bison and some hazing operations would be visible if bison venture beyond delineated SMAs. These bison management actions would have a minor to major visual impact on the landscape and for some viewers who might be opposed to shooting or hazing bison or to those viewers sensitive to these activities.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

The existing capture and test facility would continue to intrude on the viewshed at Stephens Creek. Because this facility is of a compatible design with the nearby Yellowstone National Park wrangling facilities, the impact on visual resources would be minimal. Also, this facility would not be readily visible to the majority of visitors to the park and surrounding areas.

Capture and test facilities within the viewshed on the western boundary of Yellowstone National Park would continue to adversely impact visual resources. The facility is on forest service lands that are managed for "partial retention" and "modification" of visual quality objectives and allow for some evidence of human activity. The continued visual impact of this facility and the facility located on private lands at West Yellowstone would be minor to moderate. These facilities would not be visible in major viewsheds, but some park visitors, national forest users, and local residents would see them. Bison management actions, such as hazing, shooting, and gutting, could be a major adverse visual impact for some of these viewers.

The bison population would likely increase over time if alternative 1 were implemented. This would be a positive minor impact on those seeking to view bison, and a minor to moderate adverse impact on those opposed to an increased bison population.

Cumulative Impacts

Continued operation of bison management facilities during winter and activities in addition to other ongoing changes to the scenery, such as the wrangling facilities at Stephens Creek, would constitute additional impacts on visual resources of the Greater Yellowstone area. The impact would range from minor to moderate depending on the extent of these cumulative changes in the landscape.

Conclusion

Capture and test facilities and associated bison management actions would intrude on the visual scene and have minor to moderate impacts during winter. Facilities would be located in areas where park visitation was minimal compared to other more popular areas of the park and surrounding forest lands. Activities such as hazing, shooting, and gutting of bison would be a major impact for some viewers. Increases in the bison population might have minor positive to major adverse impacts for viewers.

IMPACTS OF ALTERNATIVE 2

Analysis

Removal of capture facilities from the viewshed at Stephens Creek and West Yellowstone would restore the visual scene to more natural conditions. This would be a beneficial impact.

Grazing allotments might be modified as part of alternative 2. Private grazing operations might be changed to run nonbreeding cattle. Either could result in negligible to minor changes in the rural/ranching landscape near park boundaries. The change in the type of cattle operations would be a change in the scenery, but most viewers would not likely be aware of this; therefore, this would be a negligible impact. In the long term, cattle grazing and ranching could be modified in some allotments on lands adjacent to Yellowstone National Park, and the scenery might change to views of bison and wildlife habitat.

Through time, larger numbers of bison would be present on the landscape both inside and outside Yellowstone National Park. This would be a moderate beneficial impact on some viewers; however, some viewers opposed to increased bison use of these lands by bison would judge this as an adverse impact. The degree of impact could be minor to major, depending on the social values of the viewers.

Alternative 2 would include closing some roads now groomed for snowmobiles and other winter recreationists. The winter visual scene in some areas of Yellowstone National Park would be beneficially affected as a result of this reduction or elimination of snowmobile and oversnow activities. However, access to the interior of the park would be restricted from West Yellowstone, adversely affecting visitors and their viewing opportunities. Some portion of the snowmobile activity would likely move to the adjacent Gallatin National Forest and other

public lands near the park. There would be indeterminant adverse visual impacts on public lands from displaced recreational use. The degree of visual impact would depend on the number of snowmachines displaced and the visual quality objectives of forest lands affected.

Cumulative Impacts

The primary cumulative impact of this alternative to visual resources is the effect on winter landscapes. Additional snowmachines displaced from the park onto forest lands would be a minor to major cumulative impact in some areas. Forest lands are experiencing increasing numbers of winter visitors. Additional winter use by snowmachines affecting the visual quality of these areas might be adverse and long term. Reduction or elimination of snowmachine use in certain areas of the park would be a beneficial cumulative impact as these areas would return to a more natural scene.

Conclusion

The impact of removal of the Stephens Creek and West Yellowstone facilities would be beneficial to visual resources within the park and on the Gallatin National Forest. Increased herd movements and numbers of bison within and surrounding the park would be moderately beneficial to some viewers, but a minor to major adverse visual impact on other viewers opposed to larger bison populations in these areas. Changes in cattle grazing operations would not be noticeable to most viewers, but for others this impact might be adverse. Reduction in snowmachine use in some areas of the park would return these areas to a more natural visual scene; however, increased snowmachine use displaced onto public lands might have a minor to major cumulative impact on visual resources, depending on the visual quality objectives of those areas.

IMPACTS OF ALTERNATIVE 3

Analysis

Capture and test facilities would continue to intrude on the viewshed at Stephens Creek and would be the same as alternative 1 over the short term. Over the long term, this facility would be moved north of the park. Although the location or design of a quarantine facility for bison has not been determined, the facility would probably appear as large scaled corrals and pens within which bison would be visible. Siting of a relocated capture facility and a new quarantine facility would be sensitive to views and features of the viewshed; therefore, impacts would likely be minor.

The existing facilities at West Yellowstone would be dismantled. Removal of these facilities would be a beneficial impact on visual resources as the areas would be returned to more natural conditions.

Impacts from modified grazing allotments and uses on visual resources would be similar to that described in alternative 2.

A moderate increase in the size of the bison population over time compared to alternative 1 would result in a similar moderate benefit to those attempting to view bison; however, viewers opposed to increased bison use of public or private lands would judge this as an adverse impact. The degree of impact could range from minor to be major, depending on the social values of the viewers.

Hunters and hunting activities might be visible within viewsheds of surrounding areas. This would be a short-term impact through the winter hunting season and a minor impact in the viewshed because most viewers would not readily see these activities. However, to some viewers sensitive to killing of bison, this would be a major impact.

Cumulative Impacts

The addition of a quarantine facility and the relocation of the Stephens Creek facility would impact visual resources, when added to other changes in the landscape occurring throughout the Greater Yellowstone Area. However, given the siting objectives of these facilities to avoid sensitive areas, these impacts would likely be minor. Additional hunting activities would be a cumulative impact, but given the extent of big game hunting in the region, impacts on visual resources would be minor for most, but major for some viewers.

Conclusion

Removal of the facilities at West Yellowstone would be a minor to moderate benefit to visual resources. Impacts of hunting on the visual quality of hunting areas would be minor; however, some viewers opposed to hunting bison who happen to see this activity would consider this to be a major impact on the scenery. Increased herd movements and numbers of bison within and surrounding the park would be moderately beneficial to some viewers, but a minor to major adverse visual impact on other viewers opposed to larger bison populations in these areas. Impacts of relocation of the Stephens Creek facility and construction of a quarantine facility would be a minor impact on visual resources because the siting would avoid sensitive visual resources. Changes in grazing allotment use and cattle operations would not be readily noticeable to most viewers; therefore, the impact would be negligible.

IMPACTS OF ALTERNATIVE 4

Analysis

The existing capture facilities at West Yellowstone and at Stephens Creek would have the same impacts on visual resources as described in alternative 1. Impacts of the quarantine facility would the same as alternative 3 as described above. Impacts on viewers from changes in the bison population size would be minor and similar to identical to those in alternative 1. Impacts on visual resources from hunting would be the same as in alternative 3, although somewhat reduced as the number of hunting permits and the range over which hunting was allowed would be less than alternative 3.

Cumulative Impacts

Impacts would be the similar to alternative 3, except that grazing allotments and operations in the western SMA would not change.

Conclusion

Impacts would be similar to those described for alternatives 1 and 3; the primary difference would be that changes in grazing allotments in the western SMA and operations in either the western or northern boundary areas would not occur. Thus, the impacts on visual resources would be minor.

IMPACTS OF ALTERNATIVE 5

Analysis

Construction of capture and test facilities within Yellowstone National Park at Lamar/Crystal Bench, Blacktail Plateau, Madison River, West Yellowstone boundary area, Old Faithful/ Firehole River, and Hayden and Pelican Valleys would have a major impact on visual resources. These areas would be highly sensitive to visual intrusions, and while measures would be taken to minimize impacts, the presence of these facilities would be highly noticeable.

The capture and test facility at Stephens Creek would continue to have a minimal impact on visual resources.

Implementation of this alternative would result in significantly reduced numbers of bison. This would be a major adverse visual impact for some

viewers, but to others not supportive of maintaining a large herd size this would range from a minor to major beneficial impact.

Snowmobiling inside the park would be temporarily eliminated on some segments of roads plowed to pavement to access capture facilities. These winter recreation activities would be displaced onto surrounding USFS lands, especially near West Yellowstone. This would be a beneficial visual impact within the park, but would constitute a minor to major negative visual impact similar to that described in alternative 2 for neighboring public lands outside the park where activities would be displaced. Road closures needed to facilitate transport of seropositive bison would also prevent visitors from viewing features of the park. Some of those who are able to access areas where capture operations were ongoing might experience moderate to major adverse impacts to the winter scene.

Cumulative Impacts

The primary cumulative impact would be construction of eight additional capture facilities within the park, when added to other changes in the landscape throughout the Greater Yellowstone Area. This would be a major impact on visual resources; however, once these facilities were removed, the impact would be negated. Cumulative impacts from displaced snowmachine use would be similar to that described in alternative 2.

Conclusion

Construction of facilities in sensitive areas and decreasing numbers of bison throughout the park would have major negative impacts on visual resources. Displacement of snowmobiling would have beneficial impacts on visual resources in Yellowstone National Park and minor to major impacts on visual resources outside. Implementation of this alternative would result in significantly reduced numbers of bison. This would be a major adverse visual impact for some viewers, but to others not supportive of maintaining a large herd size, this would range from a minor to major beneficial impact.

IMPACTS OF ALTERNATIVE 6

Analysis

Construction of capture and testing facilities in the Seven-Mile bridge viewshed would be a major impact on visual resources. The visual scene would continue to be minimally affected at Stephens Creek. In phase two of this alternative, portions of the Yellowstone National Park landscape would be affected to a major degree because additional capture and test facilities would be constructed throughout the park. Impacts on visual resources would be similar to those described in alternative 5.

Implementation of this alternative would result in moderately to significantly reduced numbers of bison in phase two. This would be a major adverse visual impact for some viewers, but to others not supportive of maintaining herd size this would range from a minor to major beneficial impact.

In the long term, snowmobiling and winter recreation within the winter landscape would be modified or eliminated on certain park roads and would be a beneficial impact on the visual scene for three to four years. Displaced oversnow recreational activities would constitute a moderate to major negative visual impact on surrounding USFS lands, especially near West Yellowstone. Impacts on neighboring public lands from displaced snowmobiles would be slightly higher in this alternative than alternative 5, as the Seven-Mile Bridge capture facility would be maintained throughout the life of the management plan, resulting in the closure of roads to snowmobiles from West Yellowstone into the park. However, for those visitors able to access the park interior, capture operations might have a moderate to major adverse impact to the winter scene.

Cumulative Impacts

Impacts would be similar to alternative 5.

Conclusion

Impacts would be similar to visual resources as described in alternative 5 with the primary difference being the permanent location of the capture facility at Seven-Mile Bridge, which would be a major adverse impact on visual resources. Implementation of this alternative would result in moderately to significantly reduced numbers of bison in phase two. This would be a major adverse visual impact for some viewers, but to others not supportive of maintaining herd size this would range from a minor to major beneficial impact.

IMPACTS OF ALTERNATIVE 7: PREFERRED ALTERNATIVE

Analysis

Impacts of the Stephens Creek facility and its relocation north of the park boundary would be similar to that described in alternative 3. Continued use of the two facilities at West Yellowstone until relocation of the public land facility to Horse Butte occurs would be the same as in alternative 4. The capture facility at Horse Butte would have a moderate impact on visual resources due to its potential location in an area with higher visitor use; however, siting of the facility would be sensitive to visual resources.

Hunting activities would have similar impacts on visual resources as described for alternative 4.

Snowmachine use would be modified on one segment of road (Canyon to Fishing Bridge) if needed to control bison distribution. The kind of impact resulting from this closure would be similar to that described under alternative 5, although the magnitude of impact on visual resources would be far less. Road closures needed to facilitate transport of seropositive bison would also prevent visitors from viewing features of the park.

The primary impact would be reduction of the numbers of bison to no more than 2,500, which would have a moderate to major adverse impact on viewing opportunities for those seeking bison. For those viewers who support limiting the number of bison, reducing the number available for viewing would be a minor to major beneficial impact, depending on viewers' social values.

Cumulative Impacts

Bison management facilities would constitute an intrusion on the visual scene. The bison management facilities would add to the number of aboveground structures at Horse Butte, wherever the quarantine facility is located, and north of the park where the Stephens Creek capture facility would be relocated in the long term. However, impacts on visual resources as a result of these facilities would likely be minor to moderate, as siting would be sensitive to visual resources. The primary cumulative impact would be the reduction of the number of bison on the landscape. As changes occurred throughout the Greater Yellowstone Area to wildlife populations and scenery, the reduced number of bison on the landscape would be considered by some to be a major adverse impact, but to others a major beneficial impact. Cumulative impacts from displaced snowmachine use onto public lands might be minor to moderate and concentrated on the east side of the park should a road segment from Canyon to Fishing Bridge be closed to snowmachine use.

Conclusion

Impacts on visual resources would be similar to alternative 3; the primary exception would be the movement of the public land facility on the Madison River to Horse Butte. This would be a minor to moderate impact. The displacement of snowmachines onto USFS lands would be similar to alternative 5 in the types of impacts on

visual resources, but it would be minor in degree. Impacts from hunting on visual resources would be similar to alternative 3. The primary impact of this alternative would be the reduction of the numbers of bison, which would have a moderate to major adverse impact on viewing opportunities for those seeking bison. For those viewers who support limiting the number of bison, reducing the number available for viewing would be a minor to major beneficial impact, depending on viewers' social values.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

There would be no irreversible or irretrievable commitments of resources under the alternatives.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

Under all alternatives, except alternative 2, appearance, environmental adaptations, and seasonal distribution of bison on landscapes could vary from a greater to a lesser degree depending on the number removed.

Under alternative 2, there would be a change in some allotments' rural/ranching landscapes near park boundaries. This range land might be visibly occupied by bison and other wildlife.

UNAVOIDABLE ADVERSE IMPACTS

The management activities proposed under alternatives 5 and 6 would result in an unavoidable short-term loss of some of the bison population. Alternative 7 would result in the long-term loss of a portion of the population. Either would affect the visual resources the wild and free-ranging herd represented to viewers.

CONSULTATION AND COORDINATION

A summary of the environmental impact statement planning process and public participation, including that conducted for the 1996 *Interim Bison Management Plan and Environmental Assessment*, can be found in part 1, "Purpose of and Need for Action," in the "Scoping Process and Public Participation" chapter. A summary of the major concerns identified throughout the past several years by the public on the issues of bison management are also provided in the "Purpose of and Need for Action."

In addition to public scoping activities, agencies and tribes have been consulted throughout the preparation of the environmental impact statement. In particular, the U.S. Fish and Wildlife Service (USFWS) has been consulted with regard to threatened and endangered species and provided information for use in this environmental impact statement.

Native American tribes have been involved throughout the planning process. The 1996 *Interim Bison Management Plan/Environmental Assessment* was distributed for comment to the Crow, Northern Cheyenne, Northern Arapaho, Arapaho, Shoshone, Confederated Salish and Kootenai Tribes, Blackfeet, Nez Perce, Shoshone and Bannock, Gros Ventre and Assiniboine Tribes. Consultation with the tribes for the assessment was done both verbally and in writing. The National Park Service has consulted periodically with the InterTribal Bison Cooperative regarding its interest in a quarantine facility on tribal lands (see discussion of quarantine facility in "The Alternatives" part of the environmental impact statement). Other tribes that have expressed interest have been contacted periodically and will receive copies of this environmental impact statement (see the following "Agencies and Organizations that Received Copies of the Draft Environmental Impact Statement"). Tribes contacted from November 1995 until March 1997 for the purposes of this environmental impact statement include the following: Blackfeet, Choctaw, Crow, Eastern Shoshone, Gros Ventre-Assiniboine, Nez Perce, Northern Arapaho, Northern Cheyenne, Rosebud Lakota, Salish and Kootenai, and Shoshone-Bannock. The Crow Nation also commented on the archeological surveys conducted for the siting of possible bison management facilities both inside and outside Yellowstone National Park in 1995. Other tribes were contacted per written request, specifically the Sissiton-Wahpeton Sioux, Loyal Shawnee, Flandreay Santee Sioux, Lower Brule Sioux, Picuris Pueblo, Native Village of Mekoryuk, Round Valley Tribal Council, Modoc of Oklahoma, and Nambe Pueblo.

Readers are encouraged to send their comments on the draft environmental impact statement to the National Park Service's Denver Service Center. After the comment period concludes on this draft document, the team will review and respond to all substantive comments in the final environmental impact statement. In addition, comments received during public meetings will be addressed in the final document. The final document will be distributed to everyone who comments on the draft and all others wishing to receive a copy.

AGENCIES AND ORGANIZATIONS THAT RECEIVED COPIES OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

FEDERAL AGENCIES

Advisory Council on Historic Preservation
Department of Agriculture
- Animal & Plant Health Inspection Service
- Forest Service
  - Beaverhead National Forest
  - Bridger-Teton National Forest
  - Custer National Forest
  - Gallatin National Forest
  - Shoshone National Forest
  - Targhee National Forest
- Natural Resources Conservation Service

Department of the Army
- Corps of Engineers

Department of the Interior
- Bureau of Indian Affairs
- Fish and Wildlife Service
  - Montana Office
  - Wyoming Office
  - National Elk Refuge
  - National Wildlife Health Center
  - Red Rock Lakes National Wildlife Refuge
- National Park Service
  - Big Hole National Battlefield
  - Glacier National Park
  - Grand Teton National Park
  - Grant-Kohrs Ranch National Historic Site
  - Little Bighorn National Battlefield
  - Yellowstone National Park
  - Intermountain Regional Office
- Office of the Secretary
- U.S. Geological Survey
  - Biological Resources Division

Environmental Protection Agency

STATE AGENCIES

Idaho
- Department of Commerce
- Department of Livestock
- Fish and Game Department
- Governor's Office

Montana
- Montana Department of Agriculture
- Department of Commerce
- Department of Fish, Wildlife and Parks
- Department of Livestock

Governor's Office
Intergovernmental Review Clearinghouse
Montana State Library, U.S. & Senate Documents Dept.
Montana State University Libraries
State Historic Preservation Office

Wyoming
Department of Agriculture
Department of Environmental Quality
Department of Livestock
Game and Fish Department
Governor's Office
State Clearinghouse

LOCAL AGENCIES

City of West Yellowstone, Montana
Fremont County, Idaho
Gallatin County, Montana, Commissioners
Park County, Montana, Commissioners
Park County, Wyoming, Commissioners
Teton County, Wyoming, Commissioners

NATIVE AMERICANS

Arapaho Business Council
Blackfeet Tribe
Cheyenne River Sioux Tribe
Chippewa Cree Business Committee
Choctaw Nation of Oklahoma
Confederated Salish and Kootenai Tribes
Confederated Salish and Kootenai Tribes Preservation Officer
Crow Tribal Council
Crow Creek Sioux Tribe
Eastern Shoshone Business Council
Eastern Shoshone Cultural Committee
Flandreau Santee Sioux
Fort Belknap Community Council
Fort Hall Business Council, Shoshone and Bannock Tribes
Fort Peck Council
InterTribal Bison Cooperative
Little Shell Tribe
Lower Brule Sioux Tribe
Lower Brule Wildlife Enterprise
Loyal Shawnee Tribe
Medicine Wheel Alliance
Modoc Tribe of Oklahoma
Native Village of Mekoryuk
Nambe Pueblo
Nez Perce Cultural Resource Program
Nez Perce Tribal Council
Northern Cheyenne Tribal Council
Northern Cheyenne Tribal Council Cultural Commission

Northern Arapaho Business Council
Northern Arapaho Tribe
Oglala Sioux Parks & Recreation Authority
Picuris Pueblo
Rosebud Lakota Tribal Council
Round Valley Tribal Council
Santo Domingo Tribe
Shoshone Business Council
Shoshone-Bannock Tribes, Cultural Resource Coordination
Shoshone-Bannock Tribes, Land Use Director
Shoshone-Bannock Tribes, Land Use Policy Committee
Sisseton-Wahpeton Sioux
Taos Pueblo, Office of Natural Resource Protection
Ute Indian Tribe
Winnebago Tribe of Nebraska

ORGANIZATIONS
Alliance for the Prevention of Animal Abuses
American Buffalo Foundation
American Farm Bureau Federation
American Fisheries Society, Montana Chapter
AMFAC Recreational Services, Inc.
Audubon Society
- Rocky Mountain Region
- Bighorn
- Cheyenne High Plains
- Fremont County
- Montana Audubon Council
- Sacajawea
- Snake River
- Upper Missouri Breaks
- Utah
- Yellowstone Valley

American Wildlands, Northern Rockies Office
Bear Creek Council
Bearnet
Beartooth Alliance
Biodiversity Legal Foundation
Brucellosis Research Unit
Buffalo Bill Historical Center
Canyon Coalition
Chambers of Commerce
- Billings, Montana
- Bozeman, Montana
- Cody Country, Wyoming
- Cooke City/Silver Gate, Montana
- Gardiner, Montana
- Idaho Falls, Idaho
- Jackson Hole, Wyoming
- Lander, Wyoming

- Livingston, Montana
- Pinedale, Wyoming
- Red Lodge, Montana
- Riverton, Wyoming
- Thermopolis, Wyoming
- West Yellowstone, Montana

Citizens for Teton Valley
Defenders of Wildlife
Defenders of the Rockies
Ecology Center
Elsa Wild Animal Appeal
Fund for Animals
Gallatin Valley Snowmobile Assoc.
Georgia Earth Alliance
Great Bear Foundation
Greater Yellowstone Coalition
Greater Yellowstone Association of Conservation Districts
Grizzly Bear Education
Hamilton Stores, Inc.
Humane Education Network
Humane Society of the U.S.
Hunter of Bison
Idaho Cattle Association
Idaho Conservation League
Idaho Farm Bureau Federation
Jackson Hole Alliance for Responsible Planning
Madison Gallatin Alliance
Montana Farm Bureau Federation
Montana Farmer-Stockman
Montana Farmers Union
Montana Power
Montana Stockgrowers Association
Montana Wilderness Association
National Assoc. of State Recreation Planners
National Wildlife Federation

- Idaho Wildlife Federation
- Montana Wildlife Federation
- Wyoming Wildlife Federation
- Utah Wildlife Federation

The Nature Conservancy

- Idaho
- Montana
- Wyoming

Northern Plains Resource Council
National Parks & Conservation Association, Rocky Mountain Region
Park County (Montana) Environmental Council
Park County (Wyoming) Travel Council
Predator Project
Rocky Mountain Elk Foundation
Sierra Club

- Idaho Chapter
- Northern Plains Regional Office
- Teton Group
- Utah Chapter
- Wyoming Chapter

Star Valley Development Association
Stone Fly Society
US WEST
Utah Wilderness Association
Wasatch Mountain Club
Wild Forever
Wilderness Society

- Idaho Chapter
- Montana Chapter

Wyoming Farm Bureau Federation
Wyoming Heritage Society
Wyoming Outdoor Council
Wyoming Stockgrowers Inspector
Wyoming Travel Commission
Yellowstone Association
Yellowstone Park Medical Services
Yellowstone Park Service Stations

Because of the voluminous number of people and organizations on the mailing list, not all are listed. A complete list of names (addresses may not be released) is available upon request from the Denver Service Center, National Park Service.

PREPARERS AND CONTRIBUTORS

NAME	TITLE/RESPONSIBILITY	EDUCATION	EXPERIENCE
National Park Service, Denver Service Center			
Sarah E. Bransom	Job Captain/Quality Leader	B.A. Political Science/ Environmental Science M.S. Environmental Planning	7 years NPS, 12 years other federal experience
Steve Culver	Natural Resource Specialist; threatened and endangered species summary and appendix	B.S. Fishery Biology	12 years NPS, 8 years state experience
Joan DeGraff	Historian; cultural resources	M.A. History B.S. History/Criminal Justice	9 years NPS
David Hesker	Visual Information Specialist; graphics and artwork	B.F.A. Graphics	8 years NPS, 1 year private sector
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National Park Service, Yellowstone National Park			
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John Mack	Wildlife Biologist; bison population and related topics	B.S. Biological Sciences M.S. Fish and Wildlife Management	9 years NPS; 2 years other federal and state experience
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Chris Neher	Economist; socioeconomics, recreation, consumptive use of bison	M.A. Economics	8 years experience, Bioeconomics, Inc.
Heidi West	EIS Team Facilitator; purpose and need, alternatives	Ph.D. Environmental Science and Engineering M.A. Science Communication M.S. Biology B.S. Biology	18 years Total Quality NEPA and private practice
U.S. Department of Agriculture, Animal and Plant Health Inspection Service			
Phylo Evangelou	Senior Staff Economist; livestock economics	Ph.D., Agricultural Economics M.S. Agricultural Economics M.Ed., Earth Sciences B.A. Social Sciences	6 years APHIS, 7 years private sector
U.S. Department of Agriculture, U.S. Forest Service			
Marion Cherry	Wildlife Biologist; threatened, endangered, and sensitive species	M.S. Range Science M.S. Wildlife Science, A.B.	17 years USFS, other wildlife positions since 1976

State of Montana, Department of Fish, Wildlife and Parks			
John Mundinger	Administrative Officer, Director's Office; human health safety; brucellosis sections of purpose and need	M.S. Fish and Wildlife Management B.A. Zoology B.S. Fish and Wildlife Management	25 years experience with state
State of Montana, Department of Livestock			
Clarence Siroky	Former State Veterinarian; brucellosis control issues	DVM B.S. Animal Science	20 years experience

APPENDIXES

APPENDIX A: CHANGES AND ADJUSTMENTS TO THE 1996 INTERIM BISON MANAGEMENT PLAN

Decision on Bison Management Operations for Winter of 1997-1998

Regulations promulgated by the Council on Environmental Quality require federal agencies to review environmental analyses under the National Environmental Policy Act to determine whether the agency should supplement existing NEPA documents. An agency triggers this requirement when the agency makes substantial changes to the proposed actions that are relevant to the environmental concerns or when the agency has significant new circumstances or information relevant to the environmental concerns and bearing on the proposed action or its impacts. 40 C.F.R. 1502.9(c).

Following the winter of 1996-97, the National Park Service, together with the Animal and Plant Health Inspection Service and the Forest Service, determined that they should adjust implementation of the interim bison management plan. The federal agencies, thus, proposed adjustments to the implementation of the interim bison management plan and transmitted those to the State of Montana on September 26, 1997. Then, on October 9, 1997, the federal and state agencies met to discuss the proposed adjustments. On November 13, 1997, the federal agencies again transmitted the proposals for bison management to the State of Montana. The federal agencies recognize that these adjustments must be implemented while they continue to work with the State of Montana to develop the long-term bison management plan and EIS.

The goal of the adjustments to the implementation of the plan is to provide a generally stable bison population by reducing the number of bison killed as part of the interim bison management actions at or outside the boundary of Yellowstone National Park, while still preserving Montana's brucellosis class-free status. The federal agencies seek to reduce the number of bison that would be shot or shipped to slaughter should extreme winter weather conditions, such as those that occurred during the winter of 1996-97, cause movement of bison to or beyond the boundary. The NPS will implement the adjustments at the onset of winter so, if bison migrate from the park, the adjustments will provide the most flexibility in reducing the number of bison that the agencies need to remove.

At the northern boundary the NPS will capture and hold, throughout the winter, all bison that test seronegative until reaching the capacity of the facility. The NPS, thereafter, will selectively ship bison testing seronegative to slaughter along with those testing seropositive. The alternatives, either shipping all captured bison to slaughter, or allowing them to leave the park and go onto private lands where they likely will be shot, would not provide this flexibility and are less likely to allow stability in the bison population. Additionally, when necessary, the NPS also will implement reasonable actions within the park, primarily through hazing, to attempt to limit bison movement from the interior of the park to the northern boundary.

It is recognized that management actions in Montana are within the jurisdiction and discretion of the State of Montana. The federal agencies have recommended that the state allow low-risk bison, as defined by APHIS in both the September 26 and November 13 letters, that evade capture to remain on public lands until 60 days before cattle are released on federal grazing allotments. As set out in the November 13 letter, allowing low- risk bison wintering

on those public lands specified in the interim plan in the west boundary area will not jeopardize the brucellosis class-free status of Montana.

The adjustments that the federal agencies set out in the November 13 letter will provide for a generally stable population. The determination of what population level constitutes a viable herd or at what level the integrity of the herd would be compromised is under evaluation in the draft environmental impact statement for the interagency bison management plan for Montana and Yellowstone National Park. This decision does not address the herd viability and integrity issues because the adjustments to the implementation of the interim bison management plan will provide for a generally stable bison population, and the draft EIS is the more appropriate place for the evaluation of these complex issues.

Guided by the CEQ regulation cited above, the staff at Yellowstone National Park undertook an evaluation of the adjustments to the management actions outlined in the November 13 letter and considered the results of management actions during the winter of 1996-97. After reviewing the available information, the letters from the federal agencies to the State of Montana, Montana's responses, and the evaluation of the proposed adjustments, I have concluded that the National Park Service should implement the adjustments set out in the November 13, 1997, letter and the November 24, 1997, evaluation and also have concluded that additional analysis of those actions under NEPA is not required.

Recommended:

Marvin Jensen
Superintendent, Yellowstone National Park

Date: 11/27, 1997.

Approved:

John E. Cook
Regional Director, Intermountain Region

Date: 11/27/97, 1997

DEPARTMENT OF LIVESTOCK

MARC RACICOT, GOVERNOR

PO BOX 202001

STATE OF MONTANA

BRANDS ENFORCEMENT DIV. 406-444-2045
ANIMAL HEALTH DIV. 406-444-2043
BOARD OF LIVESTOCK - CENTRALIZED SERVICES 406-444-2023
MEAT, MILK & EGG INSPECTION DIV. 406-444-5202

HELENA, MONTANA 59620-2001

Decision Notice and Supplemental Environmental Evaluation
For the Management of Wild Bison
Originating from Yellowstone National Park

December 9, 1997

To:
Environmental Quality Council, Capitol Building, Helena, 59620-1704
Governor's Office, Capitol Building, Helena, 59620-0801
Montana State Library, 1515 E. 6th Ave., Helena, 59620-1800
Yellowstone National Park, attn: Mike Finley
Gallatin National Forest, attn: Dave Garber
APHIS Veterinary Services, attn: Wilbur Clark
Montana Stockgrower's Association, attn: Jim Peterson
Greater Yellowstone Coalition, attn: Jeanne-Marie Sauvigney
Fund for Animals, attn: Andrea Lococo
Montana Wildlife Federation, attn: Tony Jewett
Intertribal Bison Cooperative, attn: Mike Fox

The Montana Department of Livestock and the Montana Department of Fish, Wildlife & Parks have decided to manage bison that have been exposed to brucellosis and that originate from Yellowstone National Park and migrate into Montana according to the provisions of the August 9, 1996 Interim Bison Management Operating Procedures, with adjustments to those procedures as described in the attached supplement to the December 20, 1995 environmental assessment of the Interim Bison Management Operating Procedures. Such management will continue until the Interim Bison Management Operating Plan is revised, in cooperation with Yellowstone National Park, APHIS Veterinary Services and the Gallatin National Forest or until a long-term bison management plan and EIS have been completed.

Based on the supplemental environmental evaluation and a review of the applicable laws and regulations, we have determined that this action will not significantly affect the human environment. Therefore, an environmental impact statement is not required.

Sincerely,

Laurence Petersen, Executive Officer
Department of Livestock

Pat Graham, Director
Department of Fish, Wildlife & Parks

Adjustments to Interim Bison Management Operating Procedures
Supplemental Environmental Evaluation
December 9, 1997

Purpose and Need

The bison herd in Yellowstone National Park (YNP) is infected with brucellosis, a cattle disease that is regulated, pursuant to provisions of the National Brucellosis Program, by USDA Animal and Plant Health Inspection Service (APHIS) and state veterinarians. When bison migrate from YNP into Montana, they pose threats to human health and safety; risks of damage to private property; risk of transmission of brucellosis to domestic livestock; jeopardize Montana's compliance with the National Brucellosis Program; and, they may cause regulatory veterinarians to impose testing requirements on Montana cattle prior to importation to their states.

On August 9, 1996 the State of Montana, in Cooperation with the National Park Service (NPS), USDA Animal and Plant Health Inspection Service (APHIS) and USDA National Forest Service (USFS) implemented an Interim Bison Management Plan. That decision was supported with an Environmental Analysis that had been released for public comment on December 20, 1995 and a response to the public comments to that Environmental Analysis. The purpose of the Plan was to provide spatial and seasonal separation of bison and domestic cattle in order to maintain Montana's brucellosis class-free status, while permitting the bison herd within the park to fluctuate, to the maximum extent possible, in response to natural ecological processes. The plan was designed to prevent bison from leaving Yellowstone National Park across the Reese Creek boundary onto adjacent private lands; to limit the distribution in the West Yellowstone area to times, situations and locations in which the risk of brucellosis transmission from bison to cattle could be controlled; and, allow unrestricted use by bison of specified public lands in the Eagle Creek/Bear Creek area adjacent to Yellowstone National Park.

Management actions specified by the August 1996 Interim Plan include capture and transport to slaughter of all bison that approached the Reese Creek boundary; capture and transport to slaughter of all pregnant females and all other bison that test positive for brucellosis in the West Yellowstone area; capture, mark and release to federal lands all non-pregnant females and other bison that test negative for brucellosis in the West Yellowstone area during the period November 1 through April 30; shooting of all bison on private lands or that move beyond the specified distribution; shooting of all untested bison that cannot be captured in the West Yellowstone area; and, hazing bison back into the park or onto cattle free public lands as an acceptable alternative to lethal removal.

The 1996-97 winter, the first year of operation of the Interim Bison Management Plan, was unusually severe and an unusually large number of bison left or attempted to leave Yellowstone National Park and migrate into Montana. As a result, a total of 1,123 bison were removed from the Yellowstone bison population by various management actions. Capture operations were less effective because the APHIS trap was poorly located. If that facility functioned more effectively, fewer bison would have been shot in the West Yellowstone area.

The Interim Bison Management Plan allowed for contingency planning in the event of unusual

circumstances, beyond the range of environmental conditions experienced since 1984-85, to ensure that the removal of bison in Montana do not compromise the integrity of the bison herd within Yellowstone National Park. The State of Montana proposes several adjustments to the August 1996 Interim Bison Management Plan to accomplish that purpose.

The analysis presented in this document supplements the December 20, 1995 Environmental Assessment and the Decision Notice/Finding of No Significant Impact issued by the Montana Departments of Livestock and Fish, Wildlife and Parks and Yellowstone National Park on August 9, 1996.

Adjustments to the Interim Bison Management Plan

The following adjustments to the interim plan will be implemented to reduce the number of bison that are removed by management action and to provide for a generally stable bison population at current levels:

1. Whenever it is safe and practical, hazing bison back into the park or onto public lands designated for bison use will be employed as an alternative to lethal controls. NPS will haze bison to prevent movement from the park interior to the park boundary. Montana agrees with this proposal.

2. NPS will modify operations of the Stephens Creek capture facility to remove bison that serologically test positive for brucellosis, selectively hold seronegative bison through the winter and release those bison to move back into the park in the spring. Montana agrees with this proposal.

3. In the West Yellowstone area, Montana has proposed to relocate the APHIS capture facility from the Madison River location to public lands near Horse Butte. Relocation of the facility will meet the siting criteria specified in the interim plan. A permit to locate the trap has been requested from the Hebgen Lake Ranger District, Gallatin National Forest and that permit will be supported with the appropriate environmental analysis. More efficient capture operations are intended to reduce the number of seronegative bison, including non-pregnant females, that otherwise might be shot in the field.

4. During the period November 1 through April 30, the Montana State Veterinarian will determine which untested bison represent the greatest potential for brucellosis transmission to domestic livestock. All untested adult female bison and other untested bison that the Montana State Veterinarian determines pose unacceptable risk will be removed as soon as feasible. All untested bison in the proximity of cattle will be removed. At the discretion of the Montana State Veterinarian, untested calves and bulls may be tolerated on public lands during the November 1 through April 30 period. Within 60 days of anticipated return of cattle, all bison will be hazed back into Yellowstone National Park. Those which cannot be hazed, may be removed.

Impacts of Adjustments to the Interim Bison Management Plan

A supplemental evaluation of adjustments to the Interim Bison Management Plan, dated November 24, 1997, was prepared by NPS, APHIS and USFS. That evaluation is included within Montana's evaluation as Appendix "A" and is incorporated herein. Montana concurs with and adopts that analysis, with two exceptions:

1. The analysis prepared by NPS, APHIS and USFS assumes that the regulatory veterinarians in the other 49 states would agree with APHIS' determination that untested bulls, calves, yearlings and postparturient cows that have totally passed placenta represent a low risk for brucellosis transmission if removed 60 days prior to cattle returning to public lands. Without such agreement, regulatory veterinarians from other states could make independent decisions to impose testing requirements on Montana cattle prior to importation to their states. The economic effects on the livestock industry could be substantial. To avoid that economic risk, the Montana State Veterinarian may use professional discretion about whether and when to remove bison and will retain authority for the decision to remove untested bison in the West Yellowstone area.

2. The analysis prepared by NPS, APHIS and USFS assumed tolerance for untested yearling females on public lands in the West Yellowstone area, as well as tolerance for untested bulls and calves. Under deep snow conditions, it is not always possible to distinguish between yearling females and smaller, older females. Therefore, under the worst case scenario described in the analysis, 128 bison, including 13 yearling females, might be removed. This difference would not alter the conclusion that, even under a worst case scenario, adjustments to the interim plan are sufficient to provide for a generally stable bison population at current levels.

November 24, 1997

EVALUATION OF ADJUSTMENTS TO INTERIM BISON MANAGEMENT PLAN, WINTER 1997-1998

I. SUMMARY OF INTERIM BISON MANAGEMENT PLAN, WINTER 1996-97

The goal of the interim plan is to "conduct operations ... to provide spatial and seasonal separation of bison and domestic cattle in order to maintain Montana's brucellosis class-free status, while permitting the bison herd within the park to fluctuate, to the maximum extent possible, in response to natural ecological processes." (Final Interim Bison Management Plan, page 1). The objectives of the interim plan included limiting the distribution of free-ranging bison to specified federal public lands adjacent to Yellowstone National Park in the Eagle Creek/Bear Creek area, preventing bison from leaving Yellowstone National Park in the Reese Creek boundary area and moving north onto adjacent private land where cattle are grazed, and limiting bison distribution in the West Yellowstone area to times, situations, and locations in which the risk of brucellosis transmission from bison to cattle can be controlled. The Interim Bison Management Plan adopted in 1996 called for the following actions:

1. Eagle Creek/ Bear Creek Area: The Gallatin National Forest manages this area of public land north and east of the Yellowstone River and Gardiner, MT, primarily for wildlife resources. Bison would be monitored, hazing would be attempted to discourage bison from leaving this area, and no capture operations would occur in this area. The agencies would haze those bison moving beyond the Little Trail Creek-Maiden Basin hydrographic divide back into the management area. Montana Department of Livestock (DOL) would shoot those bison that could not be hazed.

2. Reese Creek Area: The Yellowstone National Park boundary at Reese Creek abuts private land that leases cattle grazing year round. This private land is located west of the Yellowstone River and north of the park boundary. As intended in the plan, the National Park Service (NPS) constructed and operated a capture facility at Stephens Creek, about 2 miles south of the Reese Creek boundary within Yellowstone National Park, to prevent bison movement onto adjacent private land. All bison moving onto the Stephens Creek flats area were expected to eventually go beyond the boundary if not hazed or captured. Hazing would be used to keep bison from moving beyond the boundary, if possible, and bison would be captured if hazing were unsuccessful. All captured bison would be shipped to slaughter. Bison that evaded capture, were unable to be hazed, and moved beyond the Reese Creek boundary would be shot. Bison shot in the field would be donated to Native American Tribes or Associations or social services organizations. Montana would sell at public auction those bison that were shipped to slaughter.

3. West Boundary Area: Bison would be monitored and all bison beyond parkboundaries between May 1 and October 31 would be hazed back into the park or shot. Between October 31 and May 1, Montana, with assistance from APHIS, would maintain capture facilities at 2 locations. Capture facilities were located at Duck Creek on private land and at the Madison River on Gallatin National Forest. Both facilities were located immediately adjacent to the park boundary. The plan called for all bison

exiting YNP to be captured and tested for exposure to *Brucella abortus*. Montana DOL would ship to slaughter those bison testing seropositive and all seronegative, pregnant females. Seronegative males and seronegative, nonpregnant females would be released on public land. DOL could choose to shoot all bison that evaded capture and testing. Bison on private land were to be shot.

4. Contingency Measures: It was not anticipated that removals from the population would exceed the range of those experienced since 1985. The largest removal previously recorded was 569 bison during the winter of 1988-89. The plan stated, "Should unusual circumstances develop that are beyond the range of environmental conditions experienced since 1984-85, the agencies may develop contingency plans to assure that removals of bison outside of cattle-free public lands in Montana do not compromise the integrity of the bison herd within Yellowstone National Park." (Final Interim Bison Management Plan, page 1).

II. RESULTS OF INTERIM BISON MANAGEMENT PLAN, WINTER 1996-97

The bison population at the beginning of the 1996-97 winter was estimated at 3,500 bison (based on a high count of 3,436 on September 24, 1996). This included 865 bison on the northern range, 265 in the Mirror-Pelican, and 2,306 in the Mary Mountain area (includes the Gibbon, Firehole, and Madison River drainage as well as the Cougar Meadows and west boundary area). The winter began within the normal range of temperatures and snowfall. In late December heavy snows, 2 to 5 feet, were followed by several days of rain in early January, immediately followed by extreme cold. These conditions caused rain saturated snow to freeze and resulted in thick crusting and ice layers that precluded bison access to forage. These conditions did not moderate until late March, 1997.

1. Contingency Measures: In November and December, bison monitoring, hazing, slaughter, and shooting operations occurred as described in the interim plan. On January 10, 1997 and January 17, 1997, YNP wrote to Montana identifying that management removals were fast approaching the levels of historic removals (569) and that contingency measures should be developed. By January 17, 1997, 532 bison had been killed. It was proposed that YNP begin testing and holding those bison testing negative at Stephens Creek capture facility as well as additional hazing from private land back into the park or into Eagle Creek. It was also requested that Montana contact private landowners to see if there were easement opportunities where bison could be allowed on private land where livestock was not present. Additionally, it was requested that Montana stop shooting bison on public land in the West Yellowstone area where no livestock were present. A number of options were discussed between NPS and Montana staff over the next several days. On January 25, 1997, YNP informed Montana that operation of the Stephens Creek capture facility had been suspended, that negative tested bison were being held, and hazing efforts were being increased. On January 29, 1997, the agency heads of NPS, USFS, and APHIS sent a letter to Montana proposing contingency measures. These measures included testing at Stephens Creek and holding test negative animals, increased hazing, and hazing of animals leaving at Reese Creek off private land back into the park. Additional proposals for the West Yellowstone

area included suspension of shooting on public land, resumption of capture operations, and barricading park roads if additional bison begin to move from the park interior. On February 7, 1997, federal agency heads provided detailed responses to questions submitted by Montana on January 30, 1997, and provided detailed proposed contingency measures. On February, 14, 1997, Montana replied and suggested a meeting as soon as possible, outlined steps Montana would take including selectively removing only adult females on public land, removing bison on private land only at the request of the landowner, increased hazing, and hazing bison back into the park at West Yellowstone, and establishment of a quarantine facility inside the park at Stephens Creek.

2. <u>Eagle Creek/ Bear Creek Area</u>: Bison began moving to this area in December. As winter progressed and conditions worsened, monitoring indicated over 250 bison were in this area at peak numbers. As numbers increased and bison spent more time in the area, some began moving west beyond Little Trail Creek. Some were hazed back into the Eagle Creek/Bear Creek area, but those bison that moved west onto private land or highway rights of way were shot.

   About 250 bison survived in the Eagle Creek/Bear Creek area and inside the park in the vicinity of Mammoth and returned to the northern range when weather moderated. With the addition of the 107 released from the Stephens Creek facility, the northern range contained about 350 animals.

3. <u>Reese Creek Area</u>: Bison began moving to the Reese Creek area in mid-December. Animals were initially hazed but large movements occurred in late December, 1996 and early January, 1997. Capture operations began on January 4, 1997 and from that date through January 17, 1997, NPS personnel captured 467 bison at the Stephens Creek facility and transferred 347 to DOL for shipment to slaughter. At that time the available slaughter facilities were full and the total number of bison killed was 567. Beginning on January 21, 1997, the NPS began testing the remaining 120 animals for exposure to brucellosis, shipped 54 seropositive animals to slaughter, four additional animals died as a result of injuries during capture operations, and held 62 seronegative bison in the capture facility.

   Starting in late January, Park personnel implemented very intensive hazing operations (virtually 24 hours per day) to keep bison away from the boundary, move bison back into the park from across the northern boundary, or move bison further into the park. Eventually, hazing became much more difficult, inefficient, ineffective, and unsafe for personnel. For example, the bison resisted the attempts to move them and also fatigued rapidly - to the point of laying down immediately when the hazing operations ceased. Further, bison weight loss during this period increased dramatically. Park personnel concluded that continuing these efforts from the end of January through the rest of the winter would have been impractical and ineffective.

   Beginning February 11, 1997, National Park Service personnel resumed capture and testing of an additional 148 bison. When capture and testing operations were stopped on February 13, 1997, a total of 61 bison were shipped to slaughter (two additional bison died as a result of injuries in

the capture facility) and 85 additional seronegative bison were held in the capture facility. The NPS was then holding and feeding a total of 147 seronegative bison in the Stephens Creek facility. The capture facility was not designed to hold bison more than a day or two and holding this large group of bison precluded operating the facility as a capture facility.

In March, as more bison migrated toward the Mammoth/Gardiner area, the park commenced hazing bison to prevent them from leaving the park or move them back into the park. DOL continued to shoot those bison that could not be hazed back into the park and moved north of the Reese Creek boundary onto adjacent private land.

In March, 35 of the 147 bison being held were transferred to Idaho for vaccine research purposes. Four female bison that tested positive at that time were transferred to Montana State University for research and one injured animal was removed. On April 24, 1997, the remaining 107 bison held in the capture facility were released and they returned on their own to the northern range.

During the winter, a total of 616 bison were captured, 462 bison were shipped to slaughter and 147 seronegative bison were held in the capture facility. In addition, NPS personnel killed six bison that received serious debilitating injuries in the capture operations. One additional bison was killed because of a previous parasite infection.

From December 30, 1996, through March 18, 1997, 257 bison that had moved out of the Eagle Creek/Bear Creek area or north of the park boundary onto private land were shot in the field. This brought the removals to 725 bison shot or shipped to slaughter, 39 additional bison removed for research purposes, plus one animal removed because of a previous parasite infection.

When comparing the number of bison on the northern range in early winter, the number of management removals, and the number of animals surviving, several hundred animals would have had to move from the interior of the park to Stephens Creek area to account for all animals removed and surviving on the northern range. This type of movement was confirmed when animals that had been captured, tested, marked, and released at Horse Butte in West Yellowstone area were subsequently observed and captured at Stephens Creek.

4. West Boundary Area: Montana constructed two capture facilities in the area north of West Yellowstone, Montana, to capture and test bison leaving the park and then ship to slaughter bison that tested seropositive and seronegative pregnant females. Montana was to release all male and nonpregnant female bison testing serologically negative. The plan provided for shooting any bison that left the park and evaded the capture facilities. By early January heavy snows and poor capture facility location largely undermined the effectiveness of the capture facilities. Bison were captured on seven occasions, November 14, 1996, November 19, 1996, December 10, 1996, January 29, 1997, February 25, 1997, March 25, 1997, and March 27, 1997. A total of 113 bison were captured with 48 (42%) seropositives or pregnant females shipped to slaughter and 65 (58%)

seronegative bison released on Horse Butte.

Untested bison that evaded capture or moved beyond the management area boundary were shot in the field from November 14, 1996 through April 15, 1997. During this period 310 bison were shot. All bison remaining in the West Yellowstone area were hazed back into the park in mid May. Classification of all bison sent to slaughter and those shot in the field in the West Yellowstone area showed 41% were males, 43% females, and 16% calves.

5. Summary of Management Removals: For the 1996/97 interim bison management operations, a total of 1,123 bison were removed from the Yellowstone bison population. A breakdown of removals north of the park boundary and at Stephens Creek includes 726 bison (462 sent to slaughter, 264 shot in the field) plus 39 additional bison sent to Idaho and Bozeman for research purposes. Removals from the West Yellowstone area includes 358 bison (48 sent to slaughter, 310 shot in the field).

III. EARLY WINTER BISON SITUATION, 1997.

1. Status and Evaluation. An aerial count of bison in YNP, conducted on July 30, 1997, resulted in the highest count so far this year. Subsequent counts in August, September, and early November observed fewer bison. Based on the July count of 1,921 adults and 248 new calves for a total count of 2,169 bison, the population is conservatively estimated at 2,200 bison.

When examining the July, 1997, count by major wintering area, the northern range count in July included 321 adults and 33 calves, for a total of 354 bison. Some shifts in population numbers may take place before bison select their wintering area but assuming 350 winter on the northern range then approximately 1,850 bison would comprise the interior population (Mary Mountain and Pelican Valley). Some bison may move to the west boundary area.

Movements in the last several decades on the northern range have been highly variable and have been episodic during extremely severe winters occasionally resulting in nearly all of the northern range population moving to the northern boundary. The variability is characterized by movements of no or few bison during mild winters, even at high populations, and large movements during severe winters at all population levels.

In contrast, movements from the interior population to the western boundary area has exhibited less variability and less volatility at different population levels. A major difference between the northern range and the interior is bison use of extensive geothermal areas in the interior which moderate the effects of severe winter weather. Movements from the interior have varied over the last decade from 0% to as much as 16% (winter 1996/97) of the interior population.

IV. ADJUSTMENTS TO INTERIM PLAN IN 1997 AND EVALUATION OF POSSIBLE IMPACTS.

The following proposed adjustments are consistent with the goal and objectives of the 1996 interim bison management plan. Over a wide range of population levels, it appears that winter weather is a major factor influencing bison movement outside park boundaries, with stronger influences on the northern range than for the park interior. One possible weather scenario is that the winter will be mild or average over the entire season. Under these conditions, little or no bison movement to the boundary areas would be expected. Learned behavior of bison that have previous experience with these boundary areas may result in some bison moving to or outside YNP in the Reese Creek and West Yellowstone areas. Lower winterkill would be expected.

A second scenario is that winter weather conditions are mild to average during the first part of the winter and become more severe during late February and March. This scenario may produce some movement of bison on the northern range during early winter but precipitate larger movements to the Reese Creek boundary later in the winter. In the past, hazing bison back into the park in late winter has been successful in reducing the number of bison killed as a result of management actions. Movements of the interior population in response to increasing winter severity are likely to be less than the response on the northern range. Moderate winterkill may occur depending on the timing of severe weather, location of snow conditions preventing access to forage, and spring breakup.

A third and worst case scenario is that winter weather conditions are severe throughout the winter. This scenario would likely produce larger movement of bison on the northern range during early winter and could conceivably result in most bison on the northern range seeking lower elevation winter range in the Mammoth, Eagle Creek/Bear Creek, and Stephens Creek areas. Similar to the winter of 1996/97, movements of bison in the interior of the park would likely occur earlier in response to increasing winter severity but total numbers of bison moving into the West Yellowstone area are likely to be less than on the northern range. Winterkill, similar to percentage levels in 1996/97, could occur.

1. Adjustments to the Interim Plan.

The overall objective of adjustments to the interim plan is to reduce the number of bison that are killed as part of interim bison management actions at or outside the Yellowstone National Park boundary and provide for a generally stable bison population at its current levels. Several actions, such as monitoring and sample data collection would continue as previously described in the interim plan. Whenever it is safe and practical, hazing bison back into the park or specified public lands (for example Eagle Creek/Bear Creek) will be considered first in order to reduce the need for lethal removal. If private landowners request bison to be removed they will be hazed off private land first, if appropriate, or shot. Landowners will still have all rights provided by state law for the removal of bison on their property. Hazing may also be attempted, between Madison Junction to Mammoth, to prevent bison movement from the interior portions of the park to the north boundary.

Reese Creek area. A second measure specifically addresses bison likely to exit at the Reese Creek boundary area. When hazing bison in the vicinity of Reese Creek to keep them within the park has failed or become ineffective, the NPS will capture all bison at the Stephens Creek capture facility and serologically test bison for exposure to brucellosis. Only seropositive bison would be sent to slaughter and seronegatives would be held in the capture facility. These bison will be held until late winter or early spring (mid- to late-April) and then released to move back into the park on their own. NPS personnel would shoot bison at the park boundary of Reese Creek that evade capture or are deemed unsafe to handle (usually large adult males).

West Yellowstone Area. In the West Yellowstone area, two capture facilities existed, one on private land and one on public land. The intent of the capture operations is to capture and test as many bison as possible that move into the West Yellowstone area. The capture facility that was on public land near the Madison River was dismantled and may be moved to other land near Horse Butte to increase capture efficiency and facilitate bison capture. Relocation of the capture facility would meet siting criteria described in the interim plan. These actions are intended to reduce the number of seronegative bison that might be shot in the field. However, in the event some bison are not captured and tested, APHIS has provided that untested low risk bison that include bulls, yearlings, calves, and postparturient cows that have totally passed placenta do not have to be shot in the field and can be allowed on certain public lands in the West Yellowstone area during the winter. APHIS has determined that allowing untested low risk bison wintering on those public lands specified in the interim plan in the west boundary area will not jeopardize the brucellosis class-free status of Montana. In addition, to further mitigate any potential risk, APHIS has determined that bison must be hazed back into Yellowstone National Park 60 days prior to cattle returning to the public lands, thus maintaining a temporal and spatial separation between cattle and bison. These adjustments will minimize the potential for the spread of brucellosis. The intent is to reduce the killing of low risk bison on public land when cattle are not present.

2. **Impacts of Adjustments to the Bison Population.**

For this evaluation, effects of the interim plan adjustments to the bison population are described for a worst case scenario under severe winter conditions. Consequently, effects are expected to be less if weather conditions are less severe (as described in the first two possible weather scenarios) and fewer bison move outside Yellowstone National Park boundaries in the West Yellowstone and Reese Creek areas.

Reese Creek area. Under severe winter conditions in 1996/97, between 200 and 250 bison left the northern winter range inside YNP and wintered in the Eagle Creek/Bear Creek area, representing 29% of the beginning winter population on the northern range. Current estimates indicate approximately 350 bison may winter in the northern range and it is expected approximately 100 (29%) bison could winter in the Eagle Creek/Bear Creek area under severe weather conditions. If the remaining 250 bison were to move to the Reese Creek area, the NPS would first attempt to hold bison in the park and haze bison further into the park. If hazing were

unsuccessful, NPS personnel would capture and test all bison moving to the Stephens Creek area, ship seropositives to slaughter, and hold seronegatives until weather conditions moderate. Assuming a 50% seroprevalence rate for bison, approximately 125 bison would be sent to slaughter and 125 would be held in the capture facility. Hazing bison between Madison Junction and Mammoth is intended to prevent bison movement from the park interior toward Mammoth and the Stephens Creek areas. If hazing were not completely successful and some bison from the park interior moved to the Stephens Creek area, the NPS would capture those bison and hold additional seronegative bison in the capture facility. If the capacity of the capture facility is reached, the NPS may selectively ship seronegative bison to slaughter. These adjustments would result in approximately 125 bison remaining in the population that might have otherwise been sent to slaughter under last years operating plan. With these adjustments, approximately 225 bison could inhabit the northern range in the spring of 1998 following a very severe winter. If NPS were to take no action, all bison leaving the park could be killed under Montana law.

<u>West Yellowstone area</u>. Under the winter conditions of 1996/97, approximately 16% of the total bison wintering in the Mary Mountain and Pelican Valley areas moved outside the Park in the West Yellowstone area. Approximately 1,850 bison are expected to winter in the Mary Mountain and Pelican Valley areas and if severe weather conditions occurred, similar to 1996/97, approximately 300 (16%) bison may move into the West Yellowstone area during the 1997/98 winter. Assuming all bison were captured and tested 126 (42%) seropositive bison and all pregnant females would be sent to slaughter. About 174 (58%) would be released and allowed to inhabit public lands during the winter.

If the capture facilities were rendered ineffective, similar to last year, only 27% of the bison in the West Yellowstone area would be captured and tested. Of the 81 that would be captured, 34 would be sent to slaughter and 47 would be released on public land in the Horse Butte area. The remaining 219 would be untested. Removal data from 1996/97 showed 41% of all bison removed were bulls, 43% were females and 16% were calves. Past removal data from 1988/89, 1991/92, 1994/95, and 1996/97 showed yearling females comprised an average of 14% of female bison older than calves (Pac and Frey 1991, Aune unpubl. data). If higher risk adult females were shot and low risk bulls (includes yearling males), female yearlings, and calves were allowed on public land in the winter, approximately 81 adult females would be shot in the field. Approximately 90 adult and yearling males, 13 yearling females, and 35 calves would be allowed to winter on public lands in the West Yellowstone area. Under this scenario, bison removals would total about 115.

<u>Total Estimated Bison Removals</u>. If the agencies were to immediately implement all adjustments to the interim bison management plan a total of 240-250 bison (125 Stephens Creek, 115-125 West Yellowstone) may be removed as a result of management actions under a worst case weather scenario. Approximately 10% of the bison population was estimated to have winterkilled during the severe winter of 1996/97 and if similar conditions existed for the 1997/98 winter, approximately 220 bison might winterkill. Winterkill might actually be less because many of the older, susceptible

animals likely died from last winter's conditions and the number of susceptible calves in the 1997 population (about 250) is substantially less than last winter's population (about 500). Total losses from the population could be as many as 460 to 470 bison. With a beginning winter population of 2,200, the following early spring population is estimated to be 1,730-1,740 or 87% of the early spring population in 1997. Under a worst case scenario and with average recruitment in spring 1998, the bison population would be expected to number approximately 2,000, within 10% of the 1997 summer estimate. Without adjustments to the interim plan, removals in a worst case scenario could number as many as 503 bison killed (250 sent to slaughter from the north boundary and 253 sent to slaughter or shot from the West Yellowstone area) as part of the interim plan plus 220 winterkill for an approximate total of 773. This may result in an early winter population of 1,427 or 71% of the early spring population in 1997.

3. **Impacts of Adjustments to Threatened and Endangered Species.**

Peregrine falcons are not found in the area during winter months. Adjustments to the interim plan are not expected to impact peregrine falcons. Whooping cranes are not found in the affected areas and will not be affected.

Bald eagles may be found along the Yellowstone River to the east of the Reese Creek area and may be present along open water corridors in the West Yellowstone area. Adjustments to the interim plan are not expected to affect bald eagles in the Reese Creek area. In the West Yellowstone area, the capture facility will be placed on public land in the Horse Butte area to avoid disturbance to bald eagles. Current measures are in place that prohibit bison removal activity within 1/2 mile of any active bald eagle nest from February 1 through May 15. The timing of activities in areas near open water and bald eagle foraging areas would be limited to periods when eagles were not foraging.

No impacts to grizzlies are predicted due to adjustments to the interim plan. Most management activity is expected to occur during winter months when bears are hibernating and capture and handling operations in the West Yellowstone and Reese Creek areas are not expected to affect grizzly bears.

Winterkill may be an important food source for bears in interior portions of Yellowstone National Park (Mattson and Knight 1992). Bison winterkill may be density-independent and largely influenced by severe weather events. For a worst case scenario under severe weather conditions, adjustments to the interim plan could result in 250 bison being killed as part of management actions. Without adjustments, as many as 503 bison could be killed. Thus, adjustments to the interim plan could potentially reduce human caused bison removals by as much as 50% compared to interim plan actions without adjustments. In a worst case scenario, adjustments to the interim plan may result in a 13% lower spring bison population compared to spring 1997 (1,740 versus 2,000) but may also result in a spring bison population 22% higher (1,740 with adjustments versus 1,427 without adjustments) than if adjustments were not implemented under similar severe winter conditions. For a worst case scenario, these

adjustments would likely result in fewer bison killed and a larger bison population than if adjustments were not implemented. These adjustments could potentially provide for a larger bison population which in turn could potentially provide more carrion for bears in the future.

Gray wolves are found in several areas of Yellowstone National Park. Adjustments to the interim plan are not expected to affect gray wolves.

4. Impacts of Adjustments on Other Wildlife

Adjustments to the interim plan are not expected to significantly impact other wildlife above that analyzed for the interim plan. Capture and handling activity in the Stephens Creek area occurs on critical pronghorn winter range and capture facilities exclude pronghorn from at least 13 acres and may temporarily affect pronghorn through displacement from a much larger area of winter range. Pronghorn may also shift their activity away from the capture facility. This interim plan and associated adjustments are short term and impacts to pronghorn are expected to be minor.

5. Impacts of Adjustments on Wetland Areas

As set out in the 1995 EA, capture facilities would be located away from sensitive wetland sites and no additional impacts to wetland areas are expected due to adjustments to the interim plan.

6. Impacts of Adjustments on Vegetation

Adjustments to the interim plan are expected to impact vegetation only to the extent described for the interim plan. Capture and handling facilities and wing fences would continue to avoid rare and sensitive plant species, and adjustments to the interim plan are not expected to impact these species.

7. Impacts of Adjustments on Cultural Resources

Consistent with the 1995 EA, adjustments to the interim plan are not expected to impact archeological resources, historic structures, cultural landscapes, or ethnographic resources.

8. Impact of Adjustments on Domestic Livestock Operations

As in the 1995 EA, adjustments to the interim plan would continue to prevent bison from coming in contact with domestic cattle on private or public lands, and Montana's brucellosis class-free status would be maintained. Adjustments to the interim plan, thus, are not expected to impact domestic livestock operations.

9. Impacts of Adjustments on Visitor Use

Adjustments to the interim plan are not expected to impact visitor use beyond that previously described for the interim plan.

Brucellosis Eradication:
Uniform Methods and Rules

Chapter 1, General Provisions—Cattle and Bison

Part II. Procedures

6. Procedures for Handling Infected or Restricted Herds

D. Approved Bison Quarantine Facilities

A group or individual may establish an approved bison quarantine facility (ABQF) to provide testing for brucellosis-exposed bison from Yellowstone and Grand Teton National Parks in order to qualify the animals as brucellosis-free. These facilities may be located in Yellowstone National Park, Grand Teton National Park, or adjacent to the Parks in the adjoining States of Idaho, Montana, or Wyoming. State and Federal animal health officials must approve each facility. Facility approval is valid for one year and can be reapproved provided all requirements are met.

State and/or Federal animal health officials will select the serological tests to be conducted, establish procedures to account for all animals entering or leaving the ABQF, and supervise all operations.

All bison entering an approved bison quarantine facility are considered to be brucellosis-exposed animals and must be permanently identified with official metal eartags and placed under quarantine restrictions. Prior to entering the facility, all animals must test negative on official brucellosis serological tests conducted at the National Veterinary Services Laboratories (NVSL) or at an approved Cooperative State-Federal Brucellosis Laboratory (CSFBL). All serological and/or milk tests conducted in the ABQF are considered preliminary and must be confirmed at NVSL or at an approved CSFBL. Specimens or milk samples for bacterial culture must also be cultured at NVSL or at an approved CSFBL.

It is recommended that test-negative bison captured during a single season entering the ABQF be placed in an ABQF holding pen until they can be sorted and penned separately into individual test groups (ITG). The holding pens and ITG pens should be separated by at least two fences that are a minimum of 10 feet apart. Upon entry into the ABQF, it is recommended, but not required, that serological tests be conducted on every bison every 30-45 days while they are in a holding pen or ITG until each animal classified as a reactor has been removed and the remaining animals test negative. If the testing results in any bison being classified as a reactor, a subsequent ITG test must be conducted on the remaining animals in the ITG at least 30 days later.

Initially, this procedure will more readily identify reactors animals, minimizing the time spent in the ABQF completing the testing requirements to qualify for quarantine release.

All *Brucella* culture-positive animals and/or all animals classified as reactors must be removed from the ABQF within 15 days of being identified. Any bison removed from the ABQF before completing the requirements to qualify for quarantine release must move under permit either to an approved research facility or to an approved slaughter facility for slaughter only. All bison that are classified as reactors because they tested positive to an official serological and/or milk test or are confirmed culture-positive must go to an approved research facility or to an approved slaughter facility for slaughter only.

Each ITG must qualify for quarantine release following the procedures listed below before any individual bison within the ITG may be released from quarantine.

1. *Sexually mature bison (3 years of age or older)*

   (a) *Males*—Male bison must pass a minimum of three consecutive negative ITG tests. The first ITG test must be conducted when the ITG starts the quarantine period. The second ITG test must be conducted at least 180 days after the first ITG test. There must be at least 12 months between the first and last consecutive negative ITG tests.

   (b) *Pregnant females*—Pregnant female bison must complete two calvings within the ABQF. Pregnant female bison not born in the facility and continually penned within a test-negative ITG must be rebred in the ABQF following their first calving to a test-negative male from a holding pen or ITG.

   An ITG test must be conducted when the ITG starts the quarantine period before the first calving, another ITG test must be conducted at least 30 days and not more than 90 days after each female has calved during the first and second calvings, and an ITG test must be conducted six months after the last animal has calved during the first and second calvings. Each postparturient female bison must have discharges, fluids, and swabs collected and cultured within 5 days after calving. There must be at least 12 months between the first and last consecutive negative ITG test.

   (c) *Nonpregnant females*—Nonpregnant female bison not born in the facility and continually penned within a test-negative ITG must be bred in the ITG to a test-negative male from a holding pen or ITG, complete a gestation cycle, calve, and pass a minimum of three consecutive negative ITG tests.

   The first ITG test must be conducted when the ITG starts the quarantine period before being bred. The second ITG test must be conducted at least 30 days and not more than 90 days after each female has calved, and the third ITG test must be conducted six months after the last animal has calved in the ITG. Each postparturient female bison must have discharges, fluids, and swabs collected and cultured within 5 days after calving. There

must be at least 12 months between the first and last consecutive negative ITG tests.

2. *Sexually immature bison (under 3 years of age)*

(a) *Immature males*—Male bison under three years of age must pass a minimum of three consecutive ITG tests. The first ITG test must be conducted when the ITG starts the quarantine period, and the last consecutive negative ITG test must be conducted after the animals are at least three years of age. The second ITG test will be conducted at least 180 days after the first ITG test. There must be at least 12 months between the first and last consecutive negative ITG tests.

(b) *Immature females*—Immature female bison under three years of age not born in the facility and continually penned within a test-negative ITG must be bred to a test-negative male from a holding pen or ITG, complete a gestation cycle, calve, and pass a minimum of three consecutive negative ITG tests.

The first ITG test must be conducted when the ITG starts the quarantine period before being bred. The second ITG test must be conducted at least 30 days and not more than 90 days after each female has calved, and the third ITG test must be conducted six months after the last animal has calved in the ITG. Each postparturient female bison must have discharges, fluids, and swabs collected and cultured within 5 days after calving. There must be at least 12 months between the first and last consecutive negative ITG tests.

3. *Calves*—Calves born in the ABQF from a test- and/or culture-negative ITG of adult pregnant females may be released from quarantine at six months of age or older provided that all of the following conditions are met: 1) there have been no reactor animals in the ITG immediately after their birth or within one month prior to their birth, 2) all calves in the ITG are serologically test-negative, 3) each adult in the ITG is serologically test-negative at least 30 days postcalving and culturally test-negative within 5 days postcalving, and 4) the adult animals in the ITG have tested negative on three consecutive herd tests over a 12 month period. For calves born to females that were pregnant at the time of entrance into the ABQF and/or calves born during a time in which reactors are disclosed, the males calves would be classified as "immature males" and be tested as in 2(a) above, the females would be classified as "immature females" and be tested as in 2(b) above, or the calves could be neutered and released from quarantine without restrictions.

4. *Test- and/or culture-positive animals or animals that die in quarantine*—Any aborted fetus, stillborn animal, or an animal that dies in the ABQF for any reason, will be necropsied, serologically tested, and its tissues and other appropriate

specimens cultured for *Brucella*. Tissue collection methods should be based on the sampling protocol outlined by the Greater Yellowstone Interagency Brucellosis Committee (GYIBC). Any culture and/or serologically test-positive animal found in an ITG will cause the ITG to restart the quarantine requirements. Restarting the quarantine requires the ITG to be tested every 30-45 days until all animals classified as reactors have been removed from the ITG and a complete ITG test is negative. Bred female bison in the ITG that have been pregnancy checked and determined not be pregnant must be sacrificed, necropsied, and specimens collected and cultured. In addition, a complete epidemiologic assessment will be made of all test or culture-positive cases of brucellosis within the ABQF. All *Brucella* culture-positive animals and/or all animals classified as reactors must be removed from the ABQF within 15 days of being identified. They must be neutered, slaughtered, or moved to an approved research facility.

5. *Breeding bulls*—Bulls must be tested negative for brucellosis within 30 days of being placed within an ITG for breeding purposes or be from an ITG that has qualified for a quarantine release.

6. *Neutered animals*—Neutered bison may be released from quarantine without restrictions.

7. *Post-quarantine requirements*— The entire ITG must qualify for quarantine release before any individual bison within the ITG may be released to a group or individual in a State or area. All animals released from the ITG must be retested at approximately six months and then one year later to verify that they remain test-negative. An agreement to test must be signed by the receiving owners or managers before the animals will be released into their custody. The agreement must also state that the animals must be kept separate from all other animals until the six month test has been completed. In addition, the State Animal Health Authorities in the State of destination must authorize movement into their State.

	Minimum tests required to release	Minimum test intervals	Minimum quarantine periods
Sexually mature males	3	**1st:** start of quarantine period **2nd:** at least 180 days after first test **3rd:** at least 12 months after first test	1 year
Pregnant females	5	**1st:** before calving **2nd:** between 30 and 90 days after each animal has calved during 1st and 2nd calvings **Last:** 6 months after last animal has calved during 1st and 2nd calvings	1½ years
Nonpregnant sexually mature females	3	**1st:** before bred **2nd:** between 30 and 90 days after each animal has calved **Last:** 6 months after last animal has calved	1½ years
Immature males	3	**1st:** start of quarantine period **2nd:** at least 180 days after first test **3rd:** at least 12 months after the first test, and at least 3 years of age	1 year
Immature females	3	**1st:** before bred **2nd:** between 30 and 90 days after each animal has calved **Last:** 6 months after last animal has calved	2½ years
Calves*	1	One test at 6 months of age	½ year

* Calves born to females that were pregnant upon entry into the ABQF and calves born in an ITG in which reactors have been disclosed shall not be released as calves.

MEMORANDUM OF UNDERSTANDING
AMONG THE
NATIONAL PARK SERVICE
STATE OF MONTANA
U.S. FOREST SERVICE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE

Purpose:

To establish an understanding among the State of Montana, the U.S. Forest Service (USFS), and the National Park Service (NPS) regarding their roles and responsibilities in the preparation of a long-term bison management plan and environmental impact statement (EIS) for the Yellowstone area.

To establish an understanding among the above and the Animal and Plant Health Inspection Service (APHIS) regarding its role as a cooperating participant in the preparation of a bison management plan and environmental impact statement for the Yellowstone area. In addition, this memorandum recognizes an informal relationship with the Ad Hoc Technical Committee for Brucellosis in Wildlife in the Greater Yellowstone Area (Ad Hoc Committee) in order to tap their knowledge and expertise as it relates to brucellosis in the greater Yellowstone area. It is recognized that many members of this committee are also agency representatives in this process.

Background Information:

In recent years, bison have emigrated during the winter months from within Yellowstone National Park to areas outside the park. Movement has occurred with the Mary Mountain herd on the west boundary near West Yellowstone, Montana, and with the Northern Range herd on the north boundary near Gardiner, Montana. Acquired knowledge of outside range areas, natural gregariousness, increased herd size, weather conditions, and human activity all appear to be factors in bison movement.

Statement of Roles:

The NPS, the State of Montana, and the USFS will be responsible as joint-lead agencies for the preparation of a bison management plan and EIS(CEQ 1501.5). Joint-lead status is so designated because each participant has significant involvement with the management of bison in the Yellowstone area. Additionally, each has approval authority for proposed actions within their jurisdiction and specific expertise related to development of the plan and the EIS. To assure adherance to schedule one of the agencies will assume a coordinator/facilitator role. The NPS representative will function as such since NPS

MEMORANDUM OF UNDERSTANDING

implementing procedures will guide the process. The joint preparation of the bison management plan and EIS reflects the agencies' belief that each must agree to the final plan if the plan is to be effective. Joint preparation is expected to reduce the duplication of regulatory requirements.

APHIS and the Ad Hoc Committee will act as cooperators and consultants in the preparation of a bison management plan and EIS. As cooperators, participation will be governed by the provisions of the CEQ regulations at 40 C.F.R., Section 1501.6. Both APHIS and the Ad Hoc Committee have special expertise with the Brucella abortus organism.

Statement of Responsibilities:

The USFS, the NPS, and the State of Montana will be jointly responsible for the preparation of the plan and EIS. The EIS will comply with the requirements of the National Environmental Policy Act, Montana Environmental Policy Act, U.S. Council on Environmental Quality and environmental policy requirements of each agency. The National Park Service's implementing procedures, as contained in NPS-12, will be followed for the preparation of the EIS.

The USFS, NPS, and the State of Montana bring special expertise to the development of this management plan. Each agency will bear its own cost for development of information directly related to its areas of expertise as described below.

The State of Montana, through the Department of Livestock and the Department of Fish, Wildlife and Parks, has particular expertise in, knowledge of, and responsibility for livestock health and management and wild game management on lands within the s___ and outside Yellowstone National Park. Specific contributions include but are not limited to:

Livestock Management Practices
Wildlife Management Practices
Brucellosis Information
Socioeconomic Concerns

The U.S. Forest Service has particular expertise in, knowledge of and responsibility for habitat on national forest lands outside Yellowstone National Park. Specific contributions include but are not limited to:

Natural Resources on USFS Lands
Cultural Resources on USFS Lands
Socioeconomic Concerns
Land Use Information
Threatened and Endangered Species

MEMORANDUM OF UNDERSTANDING

The National Park Service has particular expertise in, knowledge of and responsibility for bison and their habitat inside Yellowstone National Park. Specific contributions include but are not limited to:

Natural Resources on NPS Lands
Cultural Resources on NPS Lands
Visitor Use Concerns
Socioeconomic Concerns
Threatened and Endangered Species
Brucellosis Information

APHIS will bring special expertise to the development of this management plan and will develope information directly related to its areas of expertise as described below.

The Animal and Plant Health Inspection Service has particular expertise in the eradication of the Brucella abortus organism in domestic cattle operations. Specific contributions include but are not limited to:

Livestock Health and Management Practices
Brucellosis Information

Other Responsibilities:

The USFS, the NPS, and the State of Montana will share in acquiring, analyzing and reporting public input on the plan and EIS.

The joint-lead agencies will designate staff representatives to form a core planning team. This team will meet regularly to draft the plan and environmental documents. APHIS will be consulted on a regular basis, and representatives may attend all core planning team meetings.

The USFS, the NPS, and the State of Montana will have a representative participate at all public meetings. The NPS will be responsible for publishing and distributing the draft and final EIS and the Record of Decision.

The joint-lead agencies must be in agreement on planning procedures and plan contents at each stage of the planning process. Actions and policies prescribed within the plan must be within the authorities of each of the joint-lead agencies. Each of the agencies has responsibility for development of the plan and may have responsibility for mitigation required as part of the EIS.

This Memorandum of Understanding will be considered implemented on the date of the last signature hereto.

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding may be terminated by the withdrawal of any party hereto, upon a written 30 day notice to the other parties. This Memorandum will be terminated 60 days after completion of an approved bison management plan and EIS, with the total period not to exceed five years.

During the performance of this agreement, the participants agree to abide by the terms of Executive Order 11246 on non-discrimination and will not discriminate against any person because of race, color, religion, sex or national origin. The participants will take affirmative action to ensure that applicants are employed without regard to their race, color, religion, sex or national origin.

No member or delegate to Congress, or resident Commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

JOINT-LEAD PARTICIPANTS

Governor, State of Montana

Date May/15/92

for Regional Forester, U.S. Forest Service, Northern Region

Date 4/13/92

Regional Director, National Park Service, Rocky Mountain Region Date 1/10/92

COOPERATING PARTICIPANT

Director, Western Region,
USDA Animal and Plant Health Inspection Services-
Veterinary Services

Date 2/5/92

United States Department of Agriculture
Animal and Plant Health Inspection Service

Date 3/5/92

APPENDIX D: DRAFT BRUCELLOSIS/BISON/ELK INFORMATION NEEDS AND RESEARCH TOPICS

The following lists the major gaps in the present understanding of bison management, continuing data needs, and the necessity of improving management. Carrying out these talks will help advance scientifically sound bison and brucellosis management. This list was developed by a GYIBC technical committee. Also see "Research Efforts" section of the "Actions Common to All Alternatives" chapter.

CATEGORY	PRIORITY	STATUS
I = Disease	H = High	O = Ongoing
II = Ecology	M = Medium	P = Proposed/Planned
III = Compliance	L = Low	N = No Action

PATHOLOGY	CATEGORY	PRIORITY	STATUS
Pathologic effects of *Brucella* in bison females	I	M	O
Pathologic effects of *Brucella* in bison males	I	M	O
Pathologic effects of *Brucella* on populations of other species e, g., moose, bighorns, pronghorns.	I	L	N
EPIDEMIOLOGY			
Modes and rates of transmission under free-ranging conditions among bison by age and sex class	I	H	O
Modes and rates of transmission under free-ranging conditions between bison and elk by age and sex class	I	H	P
Modes and rates of transmission under feed ground conditions between elk and between bison and elk by age and sex class	I	H	N
Modes and risk of transmission under free-ranging conditions between bison and cattle by age and sex class and season	I	H	N
Seroprevalence (seropositive) rates of bison by age and sex	I	H	O
Infection (culture positive) rates of bison by age and sex	I	H	O
What are the most definitive or reliable sample sites to determine culture status in bison	I	H	O
Infectious (capable of shedding infectious amount) rates of bison by age and sex	I	H	?
Infective dose (ID50 or other level) for bison	I	M	N
Frequency and timing of abortion for bison	I	H	O
Bison birth/abortion behavior and relationship to fate of the fetus, placenta, placental fluids, soil/vegetation contamination and exposure opportunity by age and sex class.	I	H	O

Pathology	Category	Priority	Status
Brucella survival and persistence at infective levels in the environment, including fluids, birth material, and fetus under field conditions	I	H	O
Role of male bison in *Brucella* transmission. Can bull bison transmit venereally? Are bull bison a risk of transmission to cattle?	I	H	?
Will/can wild bison attempt to breed with domestic cattle under free ranging conditions; if so at what season?	I	H	N
Transmission risk assessment modeling and development of risk management options	I	H	P/O
Assessment of genetic resistance to *Brucella* in elk and bison including methods to identify individuals with such resistance. Techniques to utilize natural genetic resistance (if it occurs) in management of GYA populations.	I	M	N
Role, if any, of other species in *Brucella* transmission, including possible reservoirs.	I	L	N
Impact of *Brucella* on populations of other species, e.g., moose, bighorns, pronghorns.	I	L	N
***B. ABORTUS* DETECTION TECHNIQUES**			
Determination of optimum organ/site sampling for detection of *B. abortus* presence in bison and/or elk	I	H	O
Use of PCR techniques to detect *B. abortus* in vitro, tissue samples, and environmental samples	I	H	P
Evaluate NRAMP in Yellowstone bison	I	L	N
Develop and evaluate field (remote) test techniques	I	M	N
SEROLOGY			
Calibration for bison of commonly used serologic tests to evaluate serologic status and relationship to culture positive status	I	H	N
Evaluation of relationship between serologically positive bison and culture positive status	I	H	N
VACCINES			
Biosafety of parenterally delivered strain RB51 in bison	I	H	P/O
Efficacy of parenterally delivered strain RB51 in bison	I	H	P/O
Biosafety of strain RB51 in nontarget species: moose, bighorn, pronghorn, coyote, fox, rodents, birds (raptors, ravens, vultures)	I	H	P/O
Feasibility assessment of ballistic vaccination of free-ranging bison	I	H	N

PATHOLOGY	CATEGORY	PRIORITY	STATUS
Biosafety of orally delivered strain RB51 in bison	I	M	N
Efficacy of orally delivered strain RB51 in bison	I	M	N
Biosafety of parenterally delivered *B. neotomae* in bison	I	M	N
Efficacy of parenterally delivered *B. neotomae* in bison	I	M	N
Biosafety of parenterally delivered *B. neotomae* in elk	I	L	N
Biosafety of orally delivered *B. neotomae* in bison	I	L	N
Efficacy of orally delivered *B. neotomae* in bison	I	L	N
Biosafety of *B. neotomae* in nontarget species: moose, bighorn, pronghorn, coyote, fox, rodents, birds (raptors, ravens, vultures)	I	M	N
Evaluation of suitability and effectiveness of delivery options for oral vaccine systems for bison	I	M	N
Evaluation of potential development of *B. abortus* vaccine using inert, non-living, or engineered organisms.	I	M	N
Dose titration of RB51 in bison	I	H	N
QUARANTINE			
Develop bison quarantine protocols	III	M	P/O
Develop bison quarantine regulations and NEPA compliance	III	M	N
Develop quarantine design prototype	III	M	P
Determine suitable geographic locations for quarantine facilities	III	M	P
Estimate quarantine facility development and operational costs	III	M	P
Evaluate logistic and economic feasibility of quarantine	III	M	P
If quarantine feasible, determine priorities for distribution of bison that do not clear and do clear quarantine	III	M	P
BISON POPULATION DYNAMICS			
Develop aerial survey methodology for bison with sightability indices	II	H	P
Develop annual bison population estimates with statistical confidence limits	II	H	P
Determine trends of age structure of bison population	II	M	N
Determine trends of sex structure of bison population	II	M	N
Determine reproductive rates of bison by age class including pregnancy rates and birth rates, and seasonal survival/mortality rates by age and sex class	II	H	P

PATHOLOGY	CATEGORY	PRIORITY	STATUS
Develop predictive population model to estimate population response to environmental conditions and management alternatives	II	H	P
Develop minimum viable population (MVP) size estimates including persistence and genetic factors	II	H	P
Develop ecologically viable population estimates	II	H	P
Develop genetic profile including assessment of heterogeneity and immunity	II	M	N
Using population and epidemiology data estimate effects of B. abortus on bison recruitment and population dynamics.	II	M	N
Evaluation of immunocontraception options	II	L	N
BISON ECOLOGY			
Determine seasonal bison movements and distribution by age and sex class	II	H	P
Determine seasonal bison habitat selection by age and sex class	II	H	P
Determine seasonal use of roads by bison (winter and summer) by age and sex class	II	H	P
Determine survival and mortality differential of bison that use road system versus those that do not use road system	II	M	P
Determine reproductive rate differential of bison using roads versus those that do not.	II	M	P
Determine seasonal habitat preference, use, and distribution at various population levels and climatic conditions.	II	H	P
Model bison habitat, selection, and use for various population levels, population composition, and environmental conditions	II	H	P
Estimate ecological carrying capacity for bison sub-populations in northern range, Mary Mountain, and Pelican groups in YNP and population Grand Teton National Park	II	H	P
ECONOMICS			
Determine effects of and visitor preference for wildlife viewing, species preference, opportunity to see large numbers of animals.	III	M	N
Estimate economic effects of hunting bison	III	H	N
Monitor and estimate economic effects of private property damage by bison and elk	III	M	N
Determine cattle regional production, location, and seasonal distribution on public and private land	III	H	P
Determine rate and frequency of cattle vaccination rates	III	H	N

Pathology	Category	Priority	Status
Determine regulatory requirements for testing, vaccination, movements, and interstate shipment of cattle.	III	H	N
Estimate regulatory costs - APHIS, states, producers	III	H	N
SOCIAL AND CULTURAL ASPECTS			
Determine national public values and attitudes regarding bison, elk, and brucellosis	III	M	N
Determine regional public values and attitude regarding bison, elk, and brucellosis	III	M	N
Determine Park or National Forest visitor values and attitude regarding bison, elk, and brucellosis	III	M	N
Determine Native American relationships to Yellowstone bison regionally and nationally	III	M	N

APPENDIX E : LEGISLATION AND POLICY GUIDANCE

NATIONAL PARK SERVICE, U.S. DEPARTMENT OF INTERIOR

Acts of Congress

The Act of March 1, 1872 (17 Stat.32, 16 U.S.C. Sec. 22) established Yellowstone National Park, and states it is "dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people."

The Act of May 7, 1894 (28 Stat.73, 16 U.S.C. Sec. 26) established regulations prohibiting "killing, wounding, or capturing at any time of any bird or wild animal, except dangerous animals, when it is necessary to prevent them from destroying human life or inflicting an injury . . . within the limits of said park" and "for the protection of the animals and birds in the park, from capture or destruction, or to prevent their being frightened or driven from the park."

The Act of August 25, 1916 (39 Stat.535, 16 U.S.C. Secs. 1, 2, 3, as amended) established the National Park Service, and states its basic mission:

"To conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

The Act of January 24, 1923 (42 Stat. 1214 16 U.S.C. Sec. 36) authorized that the secretary of the interior "may sell or otherwise dispose of the surplus buffalo of the Yellowstone National Park herd."

The National Environmental Policy Act of 1969 (U.S.C. 4321–4347 as amended) requires consideration of the environmental effects of proposed federal actions. NEPA procedures ensure that environmental information is available to public officials and members of the public before decisions are made and before actions are taken.

The Act of August 18, 1970, as amended in 1978 (16 U.S.C. Sec. 1a-1) states "regulation of the various areas of the National Park System be consistent with and founded in the purpose established . . . to the common benefit of all the people of the United States, and that the authorization of activities be construed and the protection, management, and administration of these areas be conducted in light of the high public value and integrity of the National Park System and not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress."

The Endangered Species Act of 1973, as amended (87 Stat. 884, 16 U.S.C. 1531 et. seq.) requires the park to consult with the U.S. Fish and Wildlife Service on management actions that could affect listed threatened and endangered species. Management actions cannot jeopardize the continued existence of threatened or endangered species.

Department of Interior, Departmental Manual 516 DM 1.2F

Requires the park to "provide, to the fullest extent practicable, timely information to the public to better assist in understanding Departmental plans and programs affecting environmental quality and to facilitate their involvement in the development of such plans and programs."

National Park Service Management Policies (1988)

Park Planning in a Regional Context (2:9)

"Recognizing that parks are integral parts of larger regional environments, the National Park Service will work cooperatively with others to anticipate, avoid, and resolve potential conflicts, to protect park resources,

and to address mutual interests in the quality of life for community residents, considering economic development as well as resource and environmental protection."

Biological Resource Management (Chapter 4)
"Ecological processes altered in the past by human activities may need to be abetted to maintain the closest approximation of the natural ecosystem where a truly natural system is no longer attainable." **(Chap. 4:2)**

"The National Park Service will seek to perpetuate the native animal life as part of the natural ecosystems of the park. Management emphasis will be on minimizing human impacts on natural animal population dynamics." **(Chap. 4:5)**

"Superintendents will develop agreements with other federal, state, and local agencies, native American authorities, and private landowners where appropriate to coordinate plant and animal management activities. . . . In addition, superintendents will seek the cooperation of others in minimizing the impacts of outside influences . . . and other means of preserving and protecting park resources." **(Chap. 4:5)**

"Natural processes will be relied on to control populations of native species to the greatest extent possible. Unnatural concentrations of native species caused by human activities may be controlled if the activities causing the concentrations cannot be controlled." **(Chap. 4:6)**

"Parks having native migratory species will ensure the preservation of their populations and their habitats inside the park and will cooperate wherever possible with others to ensure the preservation of their populations and habitats outside the park. Management action may include participation in regional land use planning efforts and cooperation with states and native American authorities in the setting of game harvest regulations for lands outside the park." **(Chap. 4:7)**

"Hunting and trapping wildlife will be allowed only in parks where such use is specifically authorized." **(Chap. 4:7)**

"When individual plants or animals must be removed for any reason - hunting, fishing, pest management, or culling to reduce excess populations resulting from human activities - the National Park Service will consider the need to maintain appropriate levels of genetic diversity in the residual park population." **(Chap. 4:10)**

"The National Park Service will strive to protect the full range of genetic types (genotypes) native to plant and animal populations in the parks by perpetuating natural evolutionary processes and minimizing human interference with evolving genetic diversity." **(Chap. 4:10)**

Yellowstone National Park Master Plan (1974)
"Ongoing and future wildlife management actions will be directed toward reducing or eliminating disruptive human influences, relying, whenever possible, upon natural controls to regulate animal numbers."

Yellowstone National Park Statement for Management (1986)
"Permit natural processes to function within the park ecosystem with minimum disturbance by man's activities."

"Maintain close and harmonious relations with neighboring communities, counties, and States and work closely with other Federal agencies, private groups, organizations, and individuals to provide a full understanding of park operations and purpose."

Yellowstone National Park Resource Management Plan (1982)
Bison management practices designed "to both preserve the unique aesthetic and scientific values of its bison herds and prevent any contacts with domestic cattle."

Yellowstone National Park Resource Management Plan (1995)

The fundamental goals of Yellowstone's resource management program, as outlined in this *Resource Management Plan*, are "to preserve the natural and cultural resources of Yellowstone and to allow natural processes and interactions between resources to occur within a minimum of human influence."

Recommended projects or activities within the bison management program of the *Resource Management Plan* include continued aerial and ground monitoring of bison, cooperation with Montana and others to gather information on bison, "prepare a cooperative long-range management plan for controlling bison problems, such as reducing the possibility of *Brucella* organism transmission to cattle and reducing human conflicts and property damage outside Yellowstone National Park, while ensuring opportunities to view free-ranging bison and maintaining a self-perpetuating bison population in Yellowstone," and continued participation in the Greater Yellowstone Interagency Brucellosis Committee (GYIBC).

U.S. FOREST SERVICE, DEPARTMENT OF AGRICULTURE

Acts of Congress

The Act of May 26, 1926 (16 U.S.C. 37) to enable the secretary of the interior to acquire certain private or State lands for the purpose of providing the ". . . winter range and winter feed facilities indispensable for the adequate and proper protection, preservation, and propagation of the elk, antelope, and other game animals of the Yellowstone National Park and adjacent land . . . such lands to become part of the national forest system"

The Act of May 26, 1926, Multiple Use Sustained Yield Act of 1960 (P.L. 86-517) 16 U.S.C. 528–531 declares congressional policy that national forests shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes.

Code of Federal Regulations

36 CFR 219.19 mandates the U.S. Forest Service to manage fish and wildlife habitat "to maintain viable populations of existing native and desired non-native vertebrate species" and the Forest Service will "provide for and maintain diversity of plant and animal communities to meet overall multiple-use objectives."

36 CFR 219.19(a)(3) requires consultation with state fish and wildlife agencies and other federal agencies to coordinate planning for fish and wildlife, including planning for the reintroduction of extirpated species.

36 CFR 222.8(a)(1) states that the U.S. Forest Service has a duty to cooperate and manage with the states regarding diseases that affect livestock.

Forest Service Manual 2611.1 (1978)

Gallatin Forest Land and Resources Management Plan (Forest Plan, II-1, III-3) reiterates Forest Service policy and specifies the Forest will provide for increasing big game populations and will emphasize forage and cover needs on big game winter range.

ANIMAL AND PLANT HEALTH INSPECTION SERVICE

Acts of Congress

The Act of May 29, 1884 (Animal Industry Act; 21 U.S.C. 112 through 114a-1, 115, 117–119, 130) authorized the secretary of Agriculture to cooperate with states, farmers' associations, similar organizations, and individuals to prevent the spread of livestock diseases and to prohibit the transportation of diseased livestock from one state or territory to another.

The Act of February 2, 1903 (32 Stat. 791, 21 U.S.C. 111, 112, 120–122) authorizes the secretary of agriculture to make such regulations and take such measures as he may deem proper to prevent the introduction or dissemination of the contagion of any contagious, infectious, or communicable disease of livestock or poultry from a foreign country into the United States, or from one state or territory of the United States or the District of Columbia into another.

The Act of March 3, 1905 (33 Stat. 1264, 21 U.S.C. 123–127) authorizes the secretary of agriculture to quarantine any state or portion thereof when he determines that animals in such state or territory are affected with any contagious, infectious, or communicable disease of livestock or poultry. It also prohibits the transportation of quarantined animals from quarantined areas except in accordance with such rules and regulations the secretary may issue.

The Act of July 2, 1962 (76 Stat. 129, 21 U.S.C. 134a through 134h) authorizes the secretary of agriculture to guard against the introduction or dissemination of communicable diseases of livestock or poultry and to seize, quarantine, or dispose of in a reasonable manner (1) any animals moving in interstate or foreign commerce contrary to laws administered by the secretary to guard against such diseases; (2) any animals moving into the U.S. or interstate that are affected or exposed to such diseases of livestock or poultry, (3) any animals moved into the U.S. or interstate that were affected or exposed at the time of such movement; and (4) any animals on any U.S. premises if he determines that an extraordinary emergency exists in connection with an outbreak that threatens livestock or poultry of the U.S. The secretary is also authorized to protect the livestock or poultry of the U.S. by issuing regulations prohibiting or regulating the movement into the U.S. of any animals that are or have been affected or exposed to or otherwise treated for any such disease or are likely to introduce or disseminate such disease. It also authorizes the secretary of agriculture to designate employees to stop and inspect, without a warrant, means of conveyances and to enter upon premises with a warrant under certain circumstances.

Title 9, Code of Federal Regulations, Part 78

The regulations of 9 CFR 78 govern the interstate movement of domestic cattle, domestic bison, and swine to prevent the spread of brucellosis. The regulations provide a system for classifying states or portions of states (areas), herds, and individual animals with respect to brucellosis status. The requirements for interstate movement are based upon the disease status of the individual animal and the status of the herd, area, or state from which the animal moves.

States or portions of states are classified according to the rate of brucella infection present in livestock herds and by complying with other requirements for disease surveillance and response. The classifications are class-free, class A, class B, and class C. States or areas that do not meet the minimum standards for class C are placed under federal quarantine. Restrictions on the interstate movement of cattle, bison, and swine are generally more stringent for movements from class A states or areas than from class-free states or areas, and are more stringent for movements from class B states or areas than from class A states or areas, and so on. The most stringent restrictions are for movements from quarantined states or areas.

The regulations are authorized by 21 U.S.C. 111-114a-l, 114g, 117, 120, 121, 123-126, 134b, and 134 f; 7 CFR 2.17, 1.51, and 371.2(d).

STATE OF MONTANA, DEPARTMENT OF LIVESTOCK

Duties and Powers of Department (General Provisions) (81-1-102 MCA) states that the department shall exercise general supervision over and, so far as possible, protect the livestock interests of the state from theft and disease and recommend legislation which, in the judgment of the department, fosters this industry.

Powers of Department (Administration of Animal Health Laws) (81-2-102 MCA) states that the department may (a) supervise the sanitary conditions of livestock in this state, under provisions of the constitution and statutes of this state and the rules adopted by the department. . . . The department may quarantine livestock in this

state when the livestock is affected with or has been exposed to disease or disease-carrying medium. . . (b) foster, promote and protect the livestock industry in this state by the investigation of diseases and other subjects related to ways and means of prevention, extirpation, and control of diseases . . . and may perform any other acts and things as may be necessary or proper in the fostering, promotion, or protection of the livestock industry in this state; . . . (d) adopt rules and orders which it considers necessary or proper to prevent the introduction or spreading of infectious, contagious, communicable, or dangerous diseases affecting livestock in this state and to this end may adopt rules and orders necessary or proper governing inspections and tests of livestock intended for importation into this state before it may be imported into this state; (e) adopt rules and orders which it considers necessary or proper for the inspection, testing, and quarantine of all livestock imported into this state; . . . (I) slaughter or cause to be slaughtered any livestock in this state known to be affected with or which has been exposed to an infectious, contagious, communicable, or dangerous disease, when such slaughter is necessary for the protection of other livestock.

81-2-104 MCA states that when the department determines that is it necessary to eradicate or control an infectious, contagious, communicable, or dangerous disease of livestock in this state, in cooperation with the United States Department of Agriculture or other federal agency, and to appraise and destroy animals affected with or that have been exposed to a disease or to destroy property in order to remove the infection and complete the cleaning and disinfection of the premises or to do any act or incur any other expense reasonably necessary in suppressing this disease, the board may accept and adopt on behalf of the state the rules adopted by the United States Department of Agriculture or other federal agency under authority of an act of Congress or the portion considered necessary, suitable, or applicable. The department may adopt other rules necessary or desirable for this purpose and cooperate with the United States Department of Agriculture or other federal agency in the enforcement of the rules accepted and adopted.

81-2-108 MCA states that it shall be unlawful for any owner, agent, or person in charge of any domestic animal or animals that are known to be suffering from or exposed to a dangerous, infectious, contagious, or communicable disease to permit such animal or animals to run at large on the public range or public highway. It shall be the duty of the owner or agent or person in charge of animals that died or they have reason to suspect did die from an infectious, contagious, communicable, or dangerous disease to properly bury or burn the same.

81-2-120 and 81-2-121 MCA. The following statutory and regulatory provisions are applicable: 81-2-120 - Management of wild buffalo or bison for disease control; and 81-2-121 - Taking of publicly owned wild buffalo or bison that are present on private property.

81-2-703 MCA states that (1) except as provided in subsection (6), no animal, animal semen, or animal biologic may be brought into the state without a permit and also a health certificate. (2) The department shall issue a permit if no significant danger to the public health will ensue upon importation of the animal into the state. No permit may be issued for livestock infected with or exposed to brucellosis, tuberculosis, or any other infectious, contagious, or communicable animal disease, except that cattle with a positive reaction to a recognized test for brucellosis may be permitted entry when destined directly for slaughter at a slaughterhouse under United States Department of Agriculture supervision.

Title 32, Administrative Rules of Montana, describe the Department of Livestock's disease control responsibilities (appendix E); and Title 32, Subchapter 4 is specific to brucellosis. Portions of that rule that relate to the bison management plan include ARM 32.3.224 which states: (1) Bison may enter the state of Montana provided they enter in conformity with sections 32.3.201 through 32.3.211 and in addition are (a) officially tested negative for brucellosis within 30 days of entry except the following (I) steers, spayed heifers, and calves under 12 months of age; (ii) bison consigned directly to an official slaughtering establishment for immediate slaughter; (iii) an official calfhood vaccinate in which the first pair of permanent incisors has not erupted and which are not parturient, post parturient, or in the last trimester of pregnancy; (iv) originate in an official certified brucellosis free bison herd. . . . ARM 32.3.224A states that when estrayed or migratory bison exposed to or affected with brucellosis . . . enter into or are otherwise present within the state of Montana one of the following actions will be taken: (a) The live bison may be physically removed by the safest and most expeditious means from within the state boundaries. This means may include but not be limited to capture, trucking, hazing/aversion, or delivery to a

departmentally approved slaughterhouse; (b) If live bison cannot safety by reasonable and permanent means be removed from the state they shall be summarily destroyed where they stand by the use of firearms. If firearms cannot be used with due regard for human safety and public property, bison may be relocated to such a danger free area and destroyed by firearms or by any other practicable means of euthanasia; © When bison of necessity or unintentionally are killed through actions of the department, the carcass remains will be disposed of by the most economical means possible. This may include but not be limited to burying, incineration, rendering, or field dressing for delivery to a departmentally approved slaughterhouse or slaughter destination. The following statutory provisions are applicable: 81-2-102, 81-2-120, and 81-2-121. ARM 32.4.410 states that a herd containing reactor animals shall be quarantined by the department to specified premises. . . . A herd containing exposed animals or a contact herd may be quarantined . . . pending the results of an official test for the presence of brucellosis. ARM 32.3.417 states that animals determined to be reactor animals as the result of an official test for brucellosis must be removed from the quarantined premises and slaughtered. . . . ARM 32.3.425 states that animals in a quarantined herd other than reactor animals may not be moved from the quarantined herd or the quarantined premises, sold, given away, offered for sale, or otherwise disposed of, except as authorized by the department under written permit of the department. . . . The department shall issue a permit for the movement of animals other than reactor animals in a quarantined herd from the quarantine premises as follows: (a) for suspect and negative animals upon the condition that they are consigned directly to and their immediate destination is (I) a slaughtering establishment; (ii) for immediate marketing and slaughter; (iii) for immediate sale and shipment to a slaughtering establishment; (iv) a feedlot approved by the state veterinarian of the state of Montana as a quarantined feedlot under ARM 32.3.121, or a feedlot approved as a quarantined feedlot by the appropriate regulatory authority or another state, to be fed in such quarantined feedlot until removed from such quarantined feedlot for direct consignment to; (A) a slaughtering establishment in this state or in another state. . . . ARM 32.3.431 states that a brucellosis quarantine shall be removed by the department from a quarantined herd when two consecutive negative herd tests have been performed provided the first negative test is made not less than 30 days after the removal of all reactor animals from the herd and the second negative test (the release test) is made not less than 180 days after removal of the last reactor. (2) Upon order of the department, an owner of a herd released from brucellosis quarantine, or his agent, shall present all animals of the herd so released from quarantine still in his possession, and any animals intermingled with them since the release from quarantine, for an official assurance retest from the presence of brucellosis not sooner than 180 days after the date of release from brucellosis quarantine. . . . ARM 32.3.432 states that (1) All dead fetuses, membranes, and afterbirths from reactor animals must be destroyed immediately by burning or proper burial.

STATE OF MONTANA, DEPARTMENT OF FISH, WILDLIFE AND PARKS

Powers and Duties (87-1-201) authorizes the Montana Department of Fish, Wildlife and Parks to supervise all the wildlife, fish, game and nongame birds and the game and furbearing animals of the state.

87-1-216, MCA. Wild buffalo or bison as species in need of management-policy-department duties.

(1) The legislature finds that significant potential exists for the spread of contagious diseases to persons or livestock in Montana and for damage to persons and property by wild buffalo or bison. It is the purpose of this section:

(a) to designate publicly owned wild buffalo or bison originating from Yellowstone National Park as a species requiring disease control;

(b) to designate other wild buffalo or bison as a species in need of management; and,

© to set out specific duties for the department for management of the species.

(2) The department:

(a) is responsible for the management, including but not limited to public hunting, of wild buffalo or bison in this state that have not been exposed to or infected with a dangerous or contagious disease but may threaten persons or property;

(b) shall consult and coordinate with the department of livestock on implementation of the provisions of subsection (2)(a) to the extent necessary to ensure that wild buffalo or bison remain disease free; and,

© shall cooperate with the department of livestock in managing publicly owned wild buffalo ir bison that enter the state on public or private land from a herd that is infected with a dangerous disease, as

provided in 81-2-120, under a plan approved by the governor. The department of livestock is authorized under the provisions of 81-2-120 to regulate publicly owned wild buffalo or bison in this state that pose a threat to persons or livestock in Montana through the transmission of dangerous disease.

(3) The department and the department of livestock are strongly urged to enter into an agreement with the national park service for the long-term management of the Yellowstone national park wild buffalo or bison herd. If the national park service does not proceed in good faith in a timely manner to enter a long-term management agreement that, in the determination of the department and the department of livestock, responds adequately to the needs of Montana, the department and the department of livestock are strongly urged to take appropriate court action. The department and the department of livestock shall prepare a joint report to the 55th legislature regarding the present state of wild buffalo or bison in Montana and any progress on an agreement for the long-term management of the Yellowstone national park herd.

(4) The department may adopt rules with regard ti wild buffalo or bison that have not been exposed to or infected with a contagious disease but are in need of management because of potential damage to person or property.

Powers of the Commission (87-1-301) authorizes the Fish, Wildlife and Parks Commission to set the policies for the protection, preservation, and propagation of the wildlife, fish, game, furbearers, waterfowl, nongame species, and endangered species of the state and for the fulfillment of all other responsibilities of the department as provided by law.

House Bill 763 (1985) authorized a hunting season for bison. Although the legislature has subsequently repealed the season, House Bill 763 still is germane to a bison management plan. The statement of intent included the following: "it is the intent of the legislature that the regulated hunting of wild buffalo allowed by House Bill 763 be considered only one of many solutions available to the Department and the National Park Service for controlling the migration of wild buffalo across the boundaries of Yellowstone National Park. The legislature encourages further negotiations and cooperation between the Department and the National Park Service to seek other methods of controlling, as soon as possible, the migration of wild buffalo into Montana from Yellowstone National Park. It is the intent of the legislature that the department adopt rules flexible enough to address each situation in which wild buffalo travel across the boundaries of Yellowstone National Park into the state of Montana presenting the potential for infecting Montana livestock with brucellosis and for inflicting property damage to property owned by the residents of the state."

House Joint Resolution 32, adopted by the 1989 legislature, states: "the Senate and the House of Representatives of the State of Montana urging the National Park Service and the Montana Department of Fish, Wildlife and Parks to take immediate action to seek and implement solutions for the long term management of elk and bison in the Yellowstone Ecosystem."

"Be it further resolved that the long-term solution be directed toward addressing the regulation of elk and bison populations within Yellowstone National Park."

Montana Fish, Wildlife and Parks Commission Position Statement, March 1989, states: "the solution to elk and bison management in the Yellowstone Ecosystem lies in a combination of the following actions: Addressing the regulation of elk and bison populations within the park . . . initiating a cooperative county, state, federal and private effort to address long-term solutions for the Northern elk and bison herds both within and outside Yellowstone Park."

87-5-103 MCA authorizes the Department of Fish, Wildlife and Parks to promulgate regulations for the management of nongame wildlife. Further, it states that the department shall by such regulations establish proposed limitations relating to taking, possession, transportation, exportation, processing, sale or offer for sale, or shipment as may be deemed necessary to manage such nongame wildlife. The department may make such changes in the proposed regulations as are consistent with effective management of nongame wildlife as designated by the legislature.

APPENDIX F: SUMMARY OF BISON MANAGEMENT TECHNIQUES

In consultation with various individuals and organizations, an analysis of what constitutes humane treatment has been developed. Their input has helped to define what impacts various management techniques have on the rights and welfare of individual bison, domestic animals, and humans. The information provided by the consultants does not necessarily translate into an endorsement of any particular course of action.

Various proposals of the draft environmental impact statement involve bison management techniques such as hazing, herding, capture, handling, and transport. Euthanasia many also be required if bison are seriously injured during these procedures.

HAZING

Hazing is described as moving animals away from a facility or location. Examples of hazing are moving bison away from developed areas or from private property and back into Yellowstone Park, national forests or other federal land. Equipment and methods used for hazing bison include cracker shells or rubber bullets, careful moving of bison on foot, horseback, or by helicopter, or using a combination of these methods. The methods used in hazing vary with each situation and preferably involve those which (1) do not injure animals or cause significant physical or psychological stress, (2) are least dangerous for people involved, and (3) are least destructive to private and federal property.

Hazing can be beneficial if (1) bison do not repeatedly return to the location from where they were hazed, (2) their new location adequately provides for the physiological needs of the bison, and (3) their new location does not result in additional conflict with human activities or development.

In many situations, hazing may be detrimental to bison and bison management. Repeated hazing in early winter may produce weight loss and poor body condition, which decreases the animal's ability to endure the remaining winter. Bison can also develop avoidance behavior with repeated hazing. One consequence of this, observed in 1991, is that bison move out of the park at night to feed and return to the park before sunrise. Avoidance behavior can also result in bison overreacting to hazing by running excessively, and/or moving to higher elevations. This makes continued hazing or control actions more difficult.

Hazing bison back into the park can bring individuals into areas where other bison are present. This results in larger groups, which if they return, may be more difficult to manage, or may be beneficial if capture operations require a minimum number of animals to be efficient. In some situations, hazing bison into the park returns animals to poorer wintering conditions similar to those which had initially stimulated bison to migrate.

HERDING

Herding is described as moving animals as a group or herd to an intended location. The modes of human travel used for herding are essentially the same as for hazing, however herding usually involves moving bison farther distances with more effort to keep groups together.

The advantages and disadvantages of herding are similar to hazing. Herding can be most successful if bison are moved as quietly as possible. For this reason, helicopters and projectiles, such as cracker shells or rubber bullets, may be counter-productive. Bison can become completely unwilling to move especially after being herded several times. Under these conditions, they may stop on vantage points, such as a ridge or hill, and then splinter into groups traveling several directions.

CAPTURE

Capture is described as either herding or voluntary movement of bison into a holding facility. Because free-ranging bison are generally best managed in groups, capture of individuals is usually not practical or cost-effective.

If bison are moved or handled, operations will be most effective, by all standards, if the well-being of each animal is addressed as highest priority. Facilities and techniques designed to accommodate bison behavior and physiology in the least stressful manner available will maximize operation efficiency and minimize injuries to bison and personnel; and bison will be handled as humanely as possible.

Most holding facilities that capture bison consist of a wing fence that directs bison into a large fenced holding pasture that can be closed once bison are inside. A typical example of this type of construction is in the Theodore Roosevelt National Park south unit. Park facilities there include a wing fence that is 7 foot high with double woven wire. The wing fence directs bison into a 5.5-acre holding pasture. The holding pasture is fenced with 10 foot high woven wire on posts 10 feet apart. The additional 3 feet in height was included to accommodate elk trapping. Theodore Roosevelt National Park typically herds their bison by helicopter along the wing fence and into the holding pasture.

Previously, Yellowstone bison have been successfully gathered into corrals using helicopters. Disadvantages of using helicopters are that it is difficult to minimize physical exertion, excitement, injury, and stress in the herded bison; and some bison eventually become tolerant of helicopters and are difficult to herd.

Baiting with hay may be effective in winter and early spring to encourage bison to voluntarily move into a holding pasture or into a “trapping pasture” designed to hold small groups which can then be moved into a larger holding pasture adjacent to handling facilities. Elk Island National Park, Alberta, Canada, uses a variation of this method for their plains bison. Although herding bison into a capture facility by horseback is often ineffective because bison can easily outrun horses, herding by horseback may be effective in moving animals to baited areas. Wind Cave National Park, where salt is naturally deficient, uses salt to bait bison into capture pens.

HANDLING

Bison handling is described as procedures involving bison within a corral or holding facility. The purposes of handling bison would be to test for diseases, to mark or identify individuals, or to gather animals for transport. It can be difficult to handle wildlife within holding facilities without incurring injury or mortality of individuals. Proper facility construction and handling techniques are crucial for minimizing these problems. Components of bison handling include facilities design and construction, handling technique, personnel, and bison injuries.

Facility Design and Construction

Handling facilities are generally designed to gradually divide groups of bison into smaller groups and eventually into individual animals. In addition to needing alleys, gates, and sorting systems, abundant pens allow flexibility for sorting. To reduce injuries, bison are also separated by sex and body size.

Many contemporary facilities are designed to utilize bison behavior to minimize animal stress and injury, and maximize handling efficiency. Examples of these design principles include using curved alleys and eliminating 90° corners. All successful handling facilities, regardless of design principles, have relied on previous experience or consultation from experienced bison handling organizations when designing and constructing their facilities.

Handling Techniques

Handling techniques for bison vary among both public and private organizations. Some organizations feel it necessary to use loud and forceful actions when moving bison through handling facilities. However, research has demonstrated that in cattle, quiet handling that uses the behavior of the animal improves animal health, and reduces stress, injury, and subsequent illness (Grandin 1989). These principles also apply to bison (Temple Grandin, Professor of Animal Sciences, Colorado State University, pers. comm.). Bison owner Ken Throlsen (New Rockford, North Dakota, pers. comm.) simply states, "The louder you shout, the higher bison jump," and "The slower you move them, the quicker you will be done."

Elk Island National Park, which annually handles both wood and plains bison, also assumes a quieter, calmer approach is more successful. Their principles include (1) minimizing noise and general activity within the facility, (2) allowing the animal to walk down an alley rather than pushing it into a run, (3) utilizing the animal's flight zone by having handlers entering it just enough to move the animal, and (4) severely restricting the use of electrical prods.

Personnel

The knowledge, attitude, and habits of personnel handling bison significantly affect the animals and success of the operation. Elk Island National Park provides a handler information package, handling objectives, and rules of conduct. An orientation is provided for employees just prior to the handling operation. Theodore Roosevelt National Park noted that handling operations were physically challenging to handlers (Bob Powell, Chief Ranger, Theodore Roosevelt National Park). For this reason, handlers could be required to pass a step test.

In addition to general handlers, a veterinarian is usually needed throughout the handling process to assess and treat injuries, collect samples for disease testing, provide input on animal care, and determine conditions requiring euthanasia. It can also be valuable having a representative of an animal protection agency attend capture, handling and transport processes. The presence of such an agency can provide a positive input on the well-being of handled bison and inform the public on operation precautions and care.

Potential Injuries

The most common injury incurred by bison is loss of horn sheaths. This form of injury can be minimized with facility construction, which prevents bison from catching horns on fencing or chutes, and with quiet handling, which reduces the speed that bison move through handling facilities.

Goring is another cause of injury associated with bison in handling and transport operations. These injuries can be minimized by separating bison by sex and body size.

TRANSPORT

Transport is described as the shipment of animals, by motorized vehicles, away from the handling facility. Significant injury and stress to bison can occur during transport. Bison health is maximized if animals are sorted by sex and body size and animals are not crowded within the transport vehicle. Animals being moved interstate must meet applicable disease testing requirement and certifications.

EUTHANASIA

Euthanasia is the act of inducing a humane death in an animal. If a bison is injured seriously enough to require euthanasia, the euthanasia method chosen should be as painless and rapid as possible. The American Veterinary Medical Association (AVMA) recognizes that an accurately delivered gunshot is an acceptable method of euthanasia; for larger wildlife such as bison, the preferred target is the head or neck. Although physical methods of euthanasia, such as gunshot, may be considered by some to be aesthetically displeasing, some of these methods cause less fear and anxiety, and may be more rapid, painless, humane and practical than other forms of euthanasia (AVMA 1993).

If any bison becomes injured, an attending veterinarian can inspect the animal to assess if the injury can be treated, or if the injury is serious enough to necessitate euthanasia. Euthanasia by gunshot would be conducted only by agency personnel certified in firearms training with expert marksmanship and an understanding of animal anatomy for proper bullet placement.

The advantages of euthanasia by gunshot include (1) unconsciousness is instantaneous if the bullet is properly placed, (2) the remaining carcass is safe for consumption by humans or animals, and (3) it may be the only effective means of euthanasia. The disadvantages include (1) under some field conditions the vital target area may be difficult to hit, (2) the use of firearms may create risk to personnel, and (3) it can be aesthetically unpleasant. The disadvantages of euthanasia by gunshot can be minimized by enacting proper safety precautions and limiting nonessential personnel from areas of activity.

Another method that is acceptable for euthanizing large animals such as bison is an intravenous administration of a euthanasia solution (AVMA 1993). Barbiturates in general, such as sodium pentobarbital, are acceptable for euthanasia. Proper and effective intravenous placement is best accomplished by a licensed veterinarian.

Euthanasia by intravenous injection is best considered as a secondary option if the animal cannot be euthanized by gunshot. The advantages of intravenous injection is (1) it is the most reliable method of performing euthanasia, and (2) there is minimal discomfort to the animal. The disadvantages of this method is (1) it may be impractical or inhumane to properly restrain the animal, (2) this method may create risk to personnel, and (3) the carcass produced by this method is toxic and therefore carcasses must be disposed of by incineration or burial that will prevent consumption by humans or animals.

United States Department of Agriculture

Animal and Plant Health Inspection Service

Veterinary Services

Western Regional Office
384 Inverness Drive South
Suite 150
Englewood, CO 80112

Subject: Low Risk Bison

Date: October 17, 1997

To: Joan M. Arnoldi
Deputy Administrator, VS
Washington, DC

This memorandum defines the term "low risk bison" as it is used in the Draft Environmental Impact Statement for the Interagency Bison Management Plan for Montana and Yellowstone National Park.

DEFINITION
Low risk bison are those bison that do not present a significant risk of transferring brucellosis to livestock through environmental contamination - bulls, yearlings, calves, and postparturient female bison that have live calves and have totally passed all birth membranes.

This definition applies to untested bison for which trapping attempts have been unsuccessful, within the Special Management Area (as defined in certain EIS alternatives) in the area adjacent to the western boundary of the Park, where there is temporal separation of cattle and bison.

RATIONALE
Birth membranes and associated fluids are the greatest potential source of increasing the risk of brucellosis transmission through environmental contamination. Low risk bison, as defined above, are not capable of contaminating the environment with birth membranes and fluids. A postparturient female that has a live calf and has passed all birth membranes is not likely to be infected. In the event she is infected, the quantity of infective organisms she may shed is de minimis compared to that in the birth membranes and fluids.

Joan M. Arnoldi 2

Cattle and bison are present in the western boundary area at separate times during the year, reducing the risk of transmission. Cattle north of the Park are on private land all year long, greatly increasing the risk of transmission due to a greater potential for commingling with bison.

R. M. Nervig
R. M. Nervig
Director, Western Region
Veterinary Services

Carl Bausch
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DEPARTMENT OF LIVESTOCK

MARC RACICOT, GOVERNOR

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STATE OF MONTANA

BRANDS ENFORCEMENT DIV 406-444-2045
ANIMAL HEALTH DIV 406-444 2043
BOARD OF LIVESTOCK · CENTRALIZED SERVICES 406 444 2023
MEAT, MILK & EGG INSPECTION DIV 406-444 5202

HELENA MONTANA 59620-2001

From: Dr. Arnold Gertonson, Montana State Veterinarian

Re: "Low Risk" Definition for Yellowstone National Park Brucellosis Exposed Bison Herd

Date: April 16, 1998

The definition proposed by NPS, APHIS and USFS assumes that the regulatory veterinarians in the other 49 states would agree with APHIS' determination that untested bulls, calves, yearlings and postparturient cows that have totally passed placenta represent a low risk for brucellosis transmission if removed 30-60 days prior to cattle returning to public lands. Without such agreement, regulatory veterinarians from other states could make independent decisions to impose testing requirements on Montana cattle prior to importation to their states. The economic effects on the livestock industry could be substantial. To avoid that economic risk and risk of disease transmission, the Montana State Veterinarian may use professional discretion about whether and when to remove bison and will retain authority for the decision to remove untested bison in the West Yellowstone area.

The definition proposed by the federal agencies of low risk bison has not been adopted by the State of Montana for the following additional reasons:

1) Bison bulls can be infected with brucellosis. The mode of transmission from bulls to other animals would be from semen, urine or infective material draining from abscessed testicles if they would open.

2) Calves may be infected at birth if the dam is infected. Calves may also be infected by ingestion of milk from an infected dam and ingestion of infective material from the dam or other infected animals. It is possible that a "short yearling" bison, which is seropositive or seronegative as a neonate will remain culture positive.

3) Brucellosis infected post-parturient cows can pass infective material via discharged placental membranes, vaginal discharges, milk, or feces from a cow which has ingested placental tissue or birthing fluids from a brucellosis infected bison female which has aborted.

4) Yearlings may be infected from birth if their dam is infected, and remain infected, or become infected by the ingestion of infective material shed by infected animals. In addition, given body condition of older females, and snow conditions during seasons of operations, it is not always possible to distinguish between yearling females and smaller, poor body conditioned older females. Yearlings are by definition animals that are twelve to twenty-four months of age. It is possible for animals classified as yearlings to be pregnant, thus they would be high risk animals.

For these reasons, Montana has exercised its discretion to determine whether, and when, to remove untested bison in the West Yellowstone area.

Appendix H: Threatened, Endangered, and Sensitive Animal Species That May Occur in Areas Likely to Be Affected by Alternative Bison Management Plans

Animal Species	Status[1]			
	USFWS	USFS	MT	WY
American peregrine falcon *Falco peregrinus anatum*	FE	E	E	SSC3
Bald eagle *Haliaeetus leucocephalus*	FT	E	P	SSC2
Grizzly bear *Ursus arctcos horribilis*	FT	T	-	-
Gray wolf *Canis lupus*	FEX	-	E	-
Montana arctic grayling[2] *Thymallus arcticus grayling*	FC	S	-	-
North American lynx *Lynx canadensis*	-	S	-	SSC2
North American wolverine *Gulo gulo luscus*	-	S	-	SSC3
Harlequin duck[3] *Histrionicus histrionicus*	-	S	-	SSC3
Yellowstone cutthroat trout[2] *Oncorhyncrus clarki bouvieri*	-	S	-	-
Trumpeter swan *Cygnus buccinator*	-	S	-	SSC2

1. U.S. Fish and Wildlife Service: FE = Federal Endangered, FT = Federal Threatened, FEX = Federal experimental nonessential population, FC = Federal Candidate;
U.S. Forest Service: E = USFS endangered, T = USFS threatened, S = USFS sensitive;
State of Montana: E = MT endangered, P = MT protected (endangered and protected defined under The Nongame and Endangered Species Conservation Act, Mont. Code Ann. § 87-5-101, 1995); and
State of Wyoming (Game and Fish Status): SSC1 = WY class 1 species of special concern which includes species with ongoing habitat loss, population greatly restricted or declining, and extirpation appears possible. SSC2 = WY class 2 species in which (1) habitat is restricted or vulnerable (but no recent or significant loss has occurred) and populations are greatly restricted or declining; or (2) species with ongoing significant loss of habitat and populations that are declining or restricted in numbers and distribution (but extirpation is not imminent). SSC3 = WY class 3 species in which (1) habitat is not restricted, but populations are greatly restricted or declining (extirpation appears possible); or (2) habitat is restricted or vulnerable (but no significant loss has occurred) and populations are declining or restricted in numbers or distribution (but extirpation is not imminent); or (3) significant habitat loss is ongoing but the species is widely distributed and population trends are considered stable.
2. Grayling and cutthroat trout are typically not found in or near the affected areas. Their preferred habitat of streams and lakes would not be physically disturbed under any of the alternatives. Plus, riparian habitat and water quality would not be adversely affected. Because these species would not be affected, they were not addressed in the "Affected Environment" and "Environmental Consequences."
3. Harlequin ducks are typically not found in or near the affected areas. Their preferred habitat of swift-moving streams and the adjacent riparian and forested areas would not be physically disturbed. Site-specific mitigation would also help protect this species. Because this species would not be impacted, it was not addressed in the "Affected Environment" and "Environmental Consequences."

Sources: Montana Natural Heritage Program. Species of special concern list prepared for the *Draft Environmental Impact Statement for the Interagency Bison Management Plan*. Nov. 7, 1997; Wyoming Natural Diversity Database. Database Search for Plant and Animals of Concern. Nov. 10, 1997.

GLOSSARY • BIBLIOGRAPHY • INDEX

GLOSSARY

APHIS. Animal and Plant Health Inspection Service, United States Department of Agriculture.

bison calf. Bison that are 0–12 months old.

bison yearling. Bison that are 13–24 months old.

biological assessment. The information prepared by or under the direction of the federal agency concerning listed and proposed species and designated and proposed critical habitat that may be present in the action area and the evaluation of potential effects of the action on such species and habitat. (50 CFR 402.02)

blood testing. The withdrawal of a sample of blood from the vein of an animal for testing on one or more serological tests that are available.

brucellosis. Infection with or disease caused by the *Brucella abortus* bacteria. Also known as Bangs disease, undulant fever, and contagious abortion.

culling. The removal of an animal from the herd.

depopulate. The removal of all animals in the herd.

deterministic model. A model based on averages.

ecosystem. A complex community of plants and animals that function as an ecological unit in nature.

effectiveness (or efficacy). Ability to impact protection from abortion and infection when exposed to brucellosis.

endangered species. Any species that is in danger of extinction throughout all or a significant portion of its range. (16 USC 1532(6))

epidemiology. That field of biological science which is concerned with the relationship to the various factors and conditions which determine the frequencies and distributions of an infectious process, a disease, or a physiological state in an animal population.

feedgrounds. An area where a herd of elk are given feed during the winter months.

genetic diversity. A source of genetic material supplied by a diverse population of animals.

grazing allotments. A permit authorizing livestock to use national forest system or other lands under U.S. Forest Service control for the purpose of livestock production (see 36 CFR 222.1(b)(5)).

groomed trails. In the context of this environmental impact statement, mechanically smoothed and compacted rough surfaces of snow that provide easier movement across in either snow machines, snow cats, or skis.

GYA. Greater Yellowstone Area.

GYIBC. Greater Yellowstone Interagency Brucellosis Committee.

heifer. A female calf.

immunity. A specific defense mechanism of resistance brought about by the interaction of a specific agent and the humoral and cellular factors of the host.

immunocontraception. The induction of contraception by injecting an animal with a compound that produces an immune response that precludes pregnancy.

infectious period. The time during which the microorganism progeny are making an exit from the host or are available for transfer to a new host.

jeopardy opinion. The decision of the U.S. Fish and Wildlife Service that an action would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing reproduction, numbers, or distribution of that species (see CFR 402.02).

management situation 1 and 2 (MS1 and MS2). MS1 areas are those that contain grizzly bear population centers and/or habitat that is needed for the survival and recovery of the species. In those areas the needs of the grizzly bear are given priority over other management considerations. MS2 areas have grizzly bears, although there are no population centers, and no highly suitable habitat occurs. The needs of the grizzly bear will be given consideration where feasible. Management should accommodate grizzly populations and/or habitat use if feasible, but not to the extent of excluding other land uses. Where the importance of habitat resources for recovery has not been determined, other uses prevail to the extent that they do not preclude the possibility of restratification to MS1.

pathogenesis. The natural course of a disorder from the first interaction with the disease provoking stimuli to the changes in form and function which result or until equilibrium is reached or recovery, defect, disability, or death ensues; OR,

The natural course of a disease that results in changes in form or function of the body until the animal recovers, becomes disabled, or dies.

plowed roads. Roads where snow has been removed.

policies. A definite course of action selected by a government agency to guide and determine present and future decisions.

range management. Range management is the manipulation of rangeland components to obtain the optimum combination of goods and services for society on a sustained basis. Range management has two basic components: (1) protection and enhancement of the soil-vegetation, and (2) maintenance and improvement of the outputs of consumable range products such as red meat, fiber, wood, water, and wildlife. The range management profession deals with the plant-animal interface rather than dealing with either plants or animals in isolation. The distinguishing feature of range management is that it deals with manipulation of grazing activities by large herbivores so that both the plant and animal production will be maintained or improved. (Holechek, Pieper, and Herbel 1989, 5)

reactor. An animal that is officially classified as a brucellosis reactor based on results of one of more official tests or is positive on bacterial examination for field strain *Brucella abortus*.

recovery. Improvement in the status of a listed species to the point at which listing no longer is appropriate under the criteria set out in 16 USC 1533(a)(1)).

recovery zone. The Yellowstone grizzly bear recovery zone as defined by the Grizzly Bear Management Subcommittee of the Interagency Grizzly Bear Committee.

recruitment. The natural addition of mature calves into the adult herd.

regulation. A rule or order issued by a government agency, having the force of law under power granted through legislation.

reservoir of infection. The natural habitat of the organism in which an infectious agent lives, multiplies, and depends primarily for survival reproducing itself in such a manner that it can be transmitted to animal or man.

riparian areas. Zones of transition from aquatic to terrestrial ecosystems, dependent on surface and or subsurface water for existence, and which manifest the influence of that water.

rules. An accepted set of written procedures having the force of regulations but established by agreement between the industries, agencies, and groups involved.

rut. Breeding activity.

sensitive species. Those plant and animal species identified by a regional forester for which population viability is a concern.

seroconversion. The process whereby an animal that was previously seronegative becomes seropositive.

serological. The use of serum.

serology. The study of disease and infection in populations by the measurement of serum variables present in blood serum.

seronegative. An animal with no detectable antibody in blood serum.

seropositive. An animal with a detectable antibody titre in blood serum.

slaughter. The killing of livestock or other animals and preparation of their meat, hides, etc., for sale or for other use by humans.

special management area (or SMA). An area contiguous to the park where some of all bison may be tolerated for part or all of the year without increasing the risk of brucellosis transmission to domestic livestock.

stochastic. Random or unpredictable event such as severe winter weather, snow depth, and access to forage

test and slaughter. A procedure that involves capture, handling, and testing a group of cattle or bison for brucellosis, tuberculosis, or other communicable livestock diseases, identifying the seropositives, and removing them from the herd to a slaughter establishment for slaughter.

threatened and endangered species. Any species of fish, wildlife, and plants that is listed as threatened or endangered by the U.S. Fish and Wildlife Service.

threatened species. Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. (16 U.S.C. 1532(20))

undulant fever. A persistent human brucellosis caused by several species of *Brucella* and marked primarily by remittent fever, pain and swelling in the joints, and great weakness.

wild, free-ranging bison. Bison not routinely handled by humans that can move without restrictions within specific geographic areas.

wildlife management. The science of protecting, restoring, or manipulating populations of wild animals in order to meet any of several objectives ranging from intense human use to preservation of complete natural processes.

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